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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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THE METAL INDUSTRY

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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:

ELECTRO-PLATERS REVIEW.

Vol. 20 NEW YORK, MARCH, 1922 No. 3

Meeting of the Institute of Metals Division

A Report of the Two Sessions Held in New York, February 20-21, 1922

The Institute of Metals Division held its winter meeting on February 20 and 21, 1922, at the Engineering Building, New York. W. H. Bassett presided.

W. M. Corse, Secretary-Treasurer, reported that the membership of the Institute had grown until it was almost at the thousand mark. The following officers were elected:

Chairman—W. B. PRICE, Scoville Manufacturing Company, Waterbury, Conn.

Vice-chairman—G. K. ELLIOTT, Lunkenheimer Company, Cincinnati, O.

Secretary—W. M. CORSE, Monel Metal Products Corporation, Bayonne, N. J.

The Executive Committee was chosen as follows:

G. K. ELLIOTT, Lunkenheimer Company, Cincinnati, O.

C. T. BRAGG, Michigan Smelting & Refining Company, Detroit, Mich.

H. M. LANE, H. M. Lane Engineering Company, Detroit, Mich.

L. ADDICKS, New York, N. Y.

D. W. CAMPBELL, Columbia University, New York.

J. A. CAPP, General Electric Company, Schenectady, N. Y.

E. E. THUM, McGraw-Hill Company, New York.

GEORGE F. COMSTOCK, Titanium Alloys Manufacturing Company, Niagara Falls, N. Y.

W. A. COWAN, National Lead Company, Brooklyn, N. Y.

H. M. WILLIAMS, General Motors Research Corporation, Dayton, O.

Results Achieved by the Corrosion Committee of the British Institute of Metals

By E. E. Thum

This was a brief summary of the ten years' work of the Corrosion Committee and its published reports which cover 650 pages of the Institute's journal. It seems to be the opinion of the Committee that the failure of brass condenser tubes in marine service is caused by the inclusion of solids, harmless in themselves, but which trap corrosive substances formed during the inevitable process of slow general thinning.

Mr. Thum stated that "some zinc oxide is formed in the original membranous coating. It is slowly dissolved in salt solutions, and in the presence of carbonates may be precipitated as a white basic chloride or a green double salt with copper. If these materials adhere to the metal as crystalline plates they are distinctly protective; if they are flocculent they cause pitting by trapping the corrosive cupric chloride.

This is a general statement of the mechanism of all severe corrosion of brass in sea water. Pitting is seen to be due to a product of corrosion held in place by a deposit of some sort; the location of the pits is a matter of chance. Coke particles, clinkers, sand from various sources, pieces of glass, and even massive flakes of ferric hydrate or a piece of string all act in the same way. Electrochemical action is distinctly secondary; wherever these foreign matters find lodgment they form eddies in which cuprous chloride can lodge. Later thick deposits of bright red cuprous oxide, ruby cuprite and greenish and white basic salts accumulate. These break away on reaching a certain size, often taking with them a tiny slab of underlying metal, exposing the crystalline structure underneath in a crater which speedily fills with corrosive substances."

It was stated that de-zincification which was supposed to be the way in which the corrosion took place, did not actually occur but that a replacement of copper from the cupric chloride by the metallic zinc went on.

To prevent corrosion, protective coats of oxy-salts, insoluble sulphide or lead were considered. Pre-oxidized tubes have been favored. It is known that the oxidized layer will protect the tube for only a moderate time, perhaps three months.

Discussion

DR. KIRCHMAN. It is known that the accumulation of the deposit on the inside of the tube contributes to corrosion but this does not explain the difference in the corrosion rates in the same sort of tubes under the same conditions.

I do not believe that copper is built up on the tubes by electrolytic deposition or replacement by the zinc. There is not yet sufficient evidence to prove it. De-zincification is not yet disproved. The crystal structure and internal strains may yet be found to have a great deal to do with corrosion.

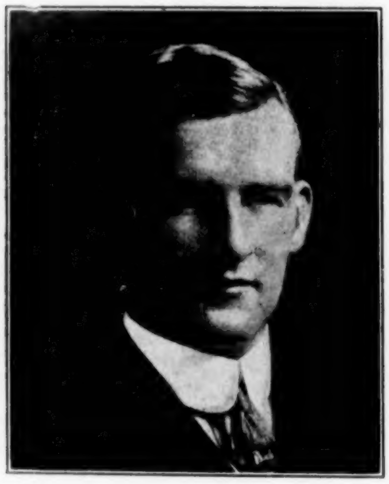
DR. P. D. MERICA. Robert J. McCay is doing work at the Mellon Institute on corrosion. It is hoped that within a short time his investigations on Corrosion by Concentrated Cells will be published.

W. H. BASSETT. I agree with Dr. Kirchman about de-zincification of tubes. There may be some cases of redeposition but my experience shows that this is not general.

DR. BURGESS. The corrosion may have been very seriously effected by impurities in the tubes. One sample analysis was 99.97 pure. That other 3/100 of a per cent may have had a considerable effect on the corrosion of the tube.

R. F. WOOD. In my experience a cast brass tube containing .7 per cent of iron showed de-zincification.

M. P. DAVIDSON. An examination under the microscope of high brass tube showed de-zincification and also that it had become brittle. Low brass showed pitting in clean holes. I believe that the design of condensers might be altered so as to permit the tubes to be cleaned out or flushed.



W. B. PRICE
Chairman

G. K. ELLIOTT
Vice-Chairman

W. M. CORSE
Secretary-Treasurer

E. E. THUM. The Corrosion Committee started out with a bias in favor of electrolytic corrosion. However, from the last two reports, which showed more knowledge and experience with the subject, and which were much more mature, seemed to have turned against this theory.

W. B. PRICE. Were these 70-30 tubes, with which the Corrosion Committee worked, hard drawn?

E. E. THUM. Yes, I believe they were.

W. B. PRICE. In that case it is difficult to interpret their results for our purpose. British condenser tubes are generally hard drawn. Ours are annealed. The grain size, hardness and crystal structure must be further investigated in order to obtain correct conclusions for our work.

Spectrum Analysis in an Industrial Laboratory

By W. H. Bassett and C. H. Davis, Waterbury, Conn.

The ease and value of the application of spectrum analysis to industrial chemistry appears to be appreciated in few of the large works laboratories of this country. For eight years, this analysis has been of great value to the authors in both analytical and metallurgical work.

To the analyst the complete qualitative analysis of an unknown alloy, revealed by a spectrogram, is a sure basis for the planning of the most direct and rapid method of attack. As the determination of each element proceeds, the purity of precipitates may be checked as often as desired.

The spectrograph proves invaluable in the recognition of impurities, the separation of which would entail a lengthy and difficult procedure, or when the weight of an unknown is less than is necessary to complete the desired determinations. A few hundredths of a gram will usually suffice for spectrographic analysis.

In the separation of the rarer elements, the spectrograph will show, with precision, the point where each step has been successful. In zinc of certain classes, indium, gallium, and germanium have been isolated in this way; the presence of antimony in lake coppers has been proved; and bismuth has been detected in zinc and in alloys where the presence of a few thousandths of a per cent, would be harmful. An antimony precipitate in a delicate determination may contain a considerable proportion of tin or arsenic, both of which will be revealed. The spectrograph is consequently important to the metallurgist as well as to the analyst.

Impurities in raw material are often a source of annoyance, especially when their detection involves delay and costly analytical work. Whether low conductivity in copper is due to arsenic, nickel, or something else may be quickly found out. Residual traces of boron, magnesium, manganese, silicon, vanadium, and other deoxidizing agents are easily identified where wet analysis may fail to reveal their presence, even after days of effort. Complex alloys of any kind are dissociated by the spectrograph into a spectrum, the reading of which gives the elements present, together with an idea of the relative amounts of each. The secrets of the inventors of alloys and hardened metals are no great problems when, for their solution, one can depend on the application of the microscope and spectrograph.

In plates accompanying the full paper, several spectrograms are given showing the dispersion and quality of the lines and instances of the general usefulness of the large quartz spectrograph.

This article is the summary of a few instances where spectrum analysis has proved its value and is intended to show the ease, accuracy, and rapidity of accomplishment in one field only—that of metallurgy.

Discussion on Spectrum Analysis

MR. DRAINNIN. Is there any data on the possibilities of getting quantitative analyses by spectroscopy?

C. H. DAVIS. I have so far done no work along these lines. Mr. Hill of Pittsburgh, and some others have, however, learned by experience to estimate very closely quantities in the case where the amounts were small.

W. H. BASSETT. Spectroscopy can be used with good results for small amounts of impurities. It is a good method of getting qualitative analyses and fairly good quantitative estimates.

DR. BURGESS. This is a very important paper. It is a new field and one which will increase in usefulness. Methods of quantitative analysis of a spectroscope are

being developed by the Bureau of Standards to check against other methods. We hope it will not be long before the Bureau will publish some material on this subject.

G. K. ELLIOTT. Would it be possible to determine small quantities of aluminum in bronze, such as is used for valves which must stand up under pressure test?

DR. BURGESS. It should be possible.

C. H. DAVIS. The spectroscope is very sensitive to aluminum magnesium and manganese and it should therefore be very easy for these metals to be discovered by this method.

Arsenical Bearing Metals

By Harold J. Roast and Charles F. Pascoe, Montreal, Que.

The object of this investigation was to compare the arsenical antimony lead alloy with some of the regular bearing-metal alloys. With this end in view, the following tests were made:

1. Chemical analyses to show the composition.
2. Thermal analyses.
3. Macroscopic examination of fractures.
4. Microscopic examination.
5. Tensile tests.
6. Crushing tests.
7. Scleroscope tests.
8. Brinell tests, at temperatures from 80° to 400° F.

Tests 3 to 8 were conducted on both sand-cast and chill-cast specimens.

For the purposes of this paper the alloys have been numbered from 1 to 6; their composition is as follows:

Number	Lead, Per Cent	Antimony, Per Cent	Tin, Per Cent	Copper, Per Cent	Arsenic, Per Cent
1	82.64	12.95	4.40	0.01	none
2	27.54	9.94	59.87	2.65	none
3	77.65	20.75	none	0.13	1.47
4	82.95	16.85	none	0.20	none
5	83.78	15.35	none	0.05	0.82
6	0.15	7.87	84.13	7.85	none

The analysis, in the case of the antimony, was made by solution in sulfuric acid and titration with permanganate. For tin, the ferric-chloride method was used; for copper, the alkaline separations, and the thiocyanate methods; for arsenic, volatilization of arsenic and titration with iodine. The lead, with the exception of alloy, was taken by difference.

With the exception of No. 5, the alloys were taken as received from the manufacturer. About 40 lb. were melted in a graphite crucible and recast into small ingots to ensure uniformity of composition; samples for analysis were taken from these remelted ingots.

Of the six alloys taken for comparison, the high tin base is undoubtedly the hardest, the strongest, and the most resistant to crushing loads. On the other hand, all the alloys stand 1,000 lb. per sq. in. without deforming, and all deform but slightly at 5,000 lb.; in other words, none would be expected to squeeze out of a bearing at ordinary loads. Leaving out No. 6, the arsenical alloys maintain their hardness as the temperature rises better than the other alloys. Structurally, the arsenical alloys have by far the finest grain while having hard crystals embedded in a softer but tough matrix. The arsenical alloys can be poured at a lower temperature than No. 6 and run more readily at, say, 700° F. than any of the other alloys. Further, they show less sign of oxidation. In the matter of cost of components, the arsenical alloys (not taking into account the special cost of alloying in the case of the latter) will be less than the high tin alloys but more than alloys 1 and 4. All of these tests have been carried out from the practical rather than the academic point of view and several lines of experimental work are suggested.

Discussion on Our Arsenical Bearing Metals

J. L. JONES. There is one important objection to arsenical metals and that is the lack of toughness. Arsenic seems to have a decided embrittling effect. Work on arsenical bearing metals should include impact tests.

W. A. COWAN. Care must be taken not to draw conclusions from this paper that arsenical alloys are better than others. The data is insufficient to prove this. Arsenic is known to make metal more brittle; moreover, tests do not show that arsenic alloys are harder at higher temperatures than the others.

W. K. FRANK. In our experience arsenic in the babbitt caused more trouble by non-adherence than arsenic in the bronze backing of a bearing.

W. M. CORSE. I should like to ask whether the grain refining effect which arsenic seems to have on babbitt is also true with respect to other metals. Would arsenic refine the grain in a high copper brass?

W. K. FRANK. We tried arsenic in a mixture of 80 copper, 10 tin and 10 lead and found that it had no grain refining effect.

H. J. ROAST. If tin is present, arsenic does not refine the crystals but rather makes them larger and coarser. This paper is not a recommendation of arsenical bearing metals. It is simply a record of our work in connection with these mixtures. We have not had sufficient opportunity to go into the matter as deeply as it deserves. As regards grain refining we have found that arsenic has the effect of refining the grain in bearing metals (that do not contain tin) over a wide range of temperature, thus making it unimportant what temperature the metal was poured at.

Dr. Bancroft's Lecture

On the morning of Tuesday, February 21st, Prof. Wilder D. Bancroft, of Cornell University, delivered a lecture on Colloid Chemistry and Metallurgy. This was the first of a series of annual lectures to be given at the New York meeting of the Institute. Professor Bancroft, who is an opponent of the amorphous metal theory, gave his reasons for his views. He declared that this theory was based on false premises, and that without granting these premises the theory could not stand. Moreover, he stated that there was no experimental proof of any kind to substantiate the theory. Prof. Bancroft offered no definite substitute for the theory, which he believed should be discarded. He declared that where there was no knowledge, free admission should be made of that fact without any attempt to guess or to theorize. He recommended more thorough knowledge of the colloid metallurgy as a means of discovering the true constitution of metals.

It was a most interesting lecture, given as only a polished and experienced speaker can give it.

The Slip Interference Theory of the Hardening of Metals by Zay Jeffries and R. S. Archer

Dr. Jeffries read a paper on this subject as a general reply to many questions raised by various commentators on a previous paper written by the same authors. The paper covered the rôle of amorphous metal, the hardening of solid solutions, constitution of austenite, the uncertainty of cementite molecule, the condition of iron in martensite, the grain size of martensite, the condition of carbon in martensite, the hardening effect of internal strain, fine grain as a principal hardener and the proof by X-rays that beta iron does not exist.

Dr. Merica read an extended discussion on this paper.

H. S. Rawden of the Bureau of Standards read two papers illustrated by lantern slides by P. Hidnert which were as follows: Thermal Expansion of Copper and Some of Its Important Alloys, Thermal Expansion of Nickel Monel Metal, Stellite, Stainless Steel and Aluminum.

Crystal Structure of Solid Solutions

By Edgar C. Bain, Cleveland, Ohio

It seems likely that one of the new avenues of approach to many metallographic problems is the study of crystal structure, or, more accurately, the atomic arrangement, by means of the X-ray spectrometer.

The crystal structure of some materials has been carefully worked out by the mineralogist, but his methods, in general, are unsuited to commercial metals and a method that yields even better information is at hand as the result of work on the diffraction of X-rays by Laue and the Bragge, and later by Hull, St. John and others. It should be understood that the contour of free crystals, which is the subject of measurements by the crystallographer, is the result of the atomic structure and, in general, bears a simple and obvious relation to it. The use of the X-ray spectrometer has been described frequently.

SUMMARY

1. A solid solution forms by replacement of solvent atoms by solvent atoms. If the pure solute is of a different crystal type from the solvent, the parent lattice changes very little in dimensions. In such cases, a limit of solubility is reached and at this point a new lattice is formed which may be an intermediate or the lattice of the solute.

2. Intermediate lattices, based on weak compounds probably, are present in the complex series.

3. When two metals, alike in crystallographic type, form continuous solid solutions there may be a gradual change in lattice size from one pure metal to the other.

4. Other supposed continuous isomorphous series are actually composed, for some range, of two separate crystalline phases. Both forms are likely in the same grain.

5. Thermal treatment may shift the range of overlapping lattices toward one or the other pure metal. The effect is most noticeable if one of the pair of metals is allotrophic.

6. For some constitutions of perfectly annealed solutions, the location of the solute atoms is probably known.

7. No case was observed where solid solution occurs by new atoms filling in the interatomic spaces (if such spaces exist), and it is not predicted that such cases will be found.

Thermal Expansion of Nickel, Monel Metal, Stellite, Stainless Steel and Aluminum

By W. F. Souder and P. Hidnert

This paper gives data on the thermal expansion of 29 samples of commercial nickel, monel metal, stellite, stainless steel, and aluminum, and results obtained by previous observers on the expansion of nickel and aluminum. All of these materials except stainless steel (heated to 900° C) were examined from room temperature to about 600° C.

The results are presented in the form of tables and curves, for example, the expansion curves of stellite show irregularities in the region between 300° and 500° C. However, for commercial nickel only a slight irregularity was perceptible at about 350° C.

For the range from room temperature to 100° C., the co-efficients of expansion vary from 9.6×10^{-6} for a sample of hardened stainless steel to 23.8×10^{-6} for a sample of exceptionally pure aluminum.

Studies on the Constitution of Binary Zinc-base Alloys

By W. M. Peirce, Palmerton, Pa.

The present work has been done in an endeavor to correlate and complete the data on the constitution of alloys of zinc with other common metals, dealing exclusively, however, with the zinc-rich alloys in which the zinc content is between 90 and 100 per cent. This investigation has included the systems lead-zinc, cadmium-zinc, iron-zinc, copper-zinc, aluminium-zinc, nickel-zinc, manganese-zinc, cobalt-zinc, tin-zinc, and magnesium-zinc. The important ternary system zinc-lead-cadmium and the zinc corners of other ternary systems have been investigated in connection with this work but are not treated in this paper.

Zinc does not form a single homogeneous zinc-rich solid solution over any considerable range of concentration with any of the metals mentioned. A limited range of solid solubility is said by previous investigators, to occur in several cases and certain effects on the properties of zinc are attributed (with varying degrees of consistency among different writers) to the presence of certain other metals dissolved in zinc. The increasing use of rolled zinc and the possibilities offered by zinc as a casting alloy in certain fields have made it essential to determine precisely these equilibrium relationships.

In carrying out this investigation, reliance was placed chiefly on two methods, conductivity measurements and microscopic analysis. The first method proved valuable in determining the existence and extent of solid solubility. The second method stands alone as a means of determining structural characteristics and supplements the first method in the measurement of solid solubility. No hardness curves are included in this paper, for in no case were they important in arriving at the constitution of any system.

It is impossible in a brief abstract to enumerate or describe the 51 diagrams illustrating the results of these valuable researches, all of which are given in detail.

An Electric Brass Founder's Soliloquy

In our issue of October, 1921, The Metal Industry published a Brass Founder's Soliloquy by W. H. Parry, who will be remembered as a Shakespearean skeptic on electric furnaces. Following is an Electric Brass Founder's Soliloquy, on the other side of the fence.

To melt electrically or not, that is the question
Whether 'twill be better to keep on with the Fuel Fired Furnace
And endure the slings and arrows of outraged customers
Or to take arms against an Open Flame Sea of trouble
And by opposing, end them with an Electric Melter;
Shall I rob myself of 10 to 15 per cent of my metal
For the sake of the time honored Coke Fired Furnace
Which I must eventually relegate to the dump?
Not so's you'd notice it, for mine, says your Uncle Wise—
Methinks it is far better to keep pace with progress
And install a battery free from heat worn crucibles,
Which will at worst assure a good metal hot as wanted.
As against the Sulphur and Gas charged "frozen stuff"
Spelter depleted; with castings by holes always peppered.
Thus making it possible for a customer's monthly rebates
Such as: 10 tons castings rejected for flaws—
Or: To profit and loss account—4,000 "bucks."
Take it from me the sure way of melting
The Non Ferrous, by using the true "Juice" sounds good.
So methinks I'll quicken my step, since the time has arrived
When all experts have convinced themselves and public as well
That the Electric is here to stay for all time
And the Fuel Fired crucible and furnace combined
Has been relegated to that forgotten field
From whose bourne no "gas asphyxiated" melter returns.

Experiments With Sherardizing

With Special Reference to the Amount and Effect of Iron in the Coating

By LEON McCULLOCH, Research Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

When clean iron and metallic zinc dust, protected from the air, are heated below the melting point of zinc, the iron takes on a coating that has excellent protective value. This coating is a brittle alloy of zinc and iron, and the process is called **sherardizing.** Although the zinc particles are covered with oxide and cannot touch the iron, an extremely small amount of the zinc vaporizes and the vapor, reaching the iron, alloys with it. Other zinc then vaporizes to replace that which has been removed from the atmosphere. This process continues indefinitely at a decreasing rate, for the coating already formed permits zinc to diffuse through it to combine with the iron beneath. In this way, the coating grows outward from the surface of the iron, as the bark grows from a tree.

The method of growth was clearly seen while sherardizing small cubes of cast iron, at about 450° C., in a small glass-stoppered bottle enclosed in a rotating drum. The dust contained about 3 per cent iron, which prevented caking, and coatings ½ in. thick were grown in a few hours. After a heavy layer had been formed, the cubes were again treated for a shorter time. The layer last formed was seen to lie next to the iron, instead of at the outer surface, showing that the growth was from the surface of the iron outward. The coatings split at the edges and corners, leaving the iron exposed there Flakes of graphite from the iron were lifted upward and embedded in the coatings.

The composition of sherardized coatings varies from the outer surface inward, as would be expected from the mode of growth. That is, the iron content increases slowly at first, then more rapidly as the iron is approached. At the surface the least amount of iron possible is 6 per cent, as the experiments described below have shown.

A study was made of the effect of iron in zinc dust on the process and on the resulting coatings. Glass bulbs, holding the small pieces to be sherardized, together with enough zinc dust to make them two-thirds full, were heated in a small, rotating electrically heated and controlled furnace. The bulbs had 6-in. (15-cm.) necks, of ⅜-in. (9.5 mm.) tubing, plugged with asbestos and zinc dust to absorb oxygen that otherwise would diffuse inwardly and oxidize the contents of the bulbs.

The dusts contained iron in amounts varying from 0 to 26 per cent. They were prepared by mixing 200-mesh zinc in the desired proportions with powdered electrolytic iron of the same fineness. These mixtures, before using, were heated until the iron particles had been thoroughly alloyed. The dusts containing less than 20 per cent iron were no longer magnetic, so that magnetic separations of iron was impossible. Only oxidized particles or free iron could then be taken out. (In these dusts, pieces of very thin iron foil were placed and heated for long periods, until it was thought that they had taken up all the zinc possible. In order to hasten the action, the foil before using was converted into an alloy with 50 per cent zinc, by heating to redness in a dust containing 30 per cent iron). The alloyed strips after the long heating in these dusts were carefully freed from dust and were analyzed. The results were as follows:

IRON IN DUST, PER CENT	PER CENT IRON FOUND IN RESULTING ALLOYS AFTER				
	2 DAYS, 365° C.	3 DAYS, 415° C.	5 DAYS, 415° C.	14 DAYS, 415° C.	45 DAYS, 415°C.
0	6.1	6.0		6.0	6.15
3		6.3			
5					6.10
7					7.81
9					11.13
10			14.1	15.5	
11					14.9
14				20.2	
18				21.7	
22				27.7	
26				43.6	

From the curve between iron in the dusts and iron in the resulting alloys, certain conclusions can be drawn:

It is evident that no part of sherardized coating can contain less than 6 per cent iron, as heating even for 45 days fails to lower the amount. When the dust contains less than 6 per cent iron, the resulting alloy contains 6 per cent. As the iron is increased from 6 per cent to about 10 per cent the composition of the alloy changes proportionally. This indicates the existence of the solid solution *n*, varying in composition from 6 to 10 per cent iron. When the iron in the dust exceeds 10 per cent, the composition of the alloy changes rapidly to about 20 per cent. And when 20 per cent iron in the dust is exceeded, the iron in the alloy rises abruptly to a high value; the compound $FeZn_3$ is thus indicated.

These results are in general accord with the well-known equilibrium diagram for the zinc-iron alloys.[1] There is this material difference: These results show iron to be insoluble in zinc at temperatures below the melting point, while the diagram indicates a solid solution containing about 1 per cent iron.

The indicated constituents of a sherardized coating are the following: The solution *n*, varying in composition between 6 and 10 per cent iron; the compound $FeZn_3$; and possibly the 20 per cent solution of zinc in iron described by Raydt and Tammann. Next to the iron is the solid solution of zinc in iron, in amounts too small to be detected; then there is a very thin layer of the compound $FeZn_3$, and beyond this the relatively thick layer of solid solution *n*, on which the protection of the iron depends. $FeZn_3$ can have little protective value, for it readily rusts when placed in water. For example, coatings formed in dust containing 11 per cent iron immediately rusted in salt spray, while coatings formed in dust with 9 per cent iron showed good resistance.

The iron content in a dust should be low, but there is some question as to what the limits should be. "Dross" dust containing iron is cheap and the percentage of iron increases with use, as zinc is removed while the iron remains. Iron in dust is useful as it raises the melting point and prevents fusing or caking when a high temperature is used to give rapid deposition. Iron, however, rapidly lowers the rate of deposition, making it necessary to employ higher temperatures, as the following figures show:

*Read at the New York meeting, Institute of Metals Division, Feb. 20, 1922.

[1]G. H. Gulliver: "Metallic Alloys," 336. Ed. 3, London, 1919. Griffin & Co., Ltd.; Von U. Raydt and G. Tammann; Zeit. Anorg. Chem. (1913) 83, 257-266.

IRON IN DUST, PER CENT	TEMPERATURE TO DEPOSIT 0.1 G. ZINC PER HOUR.
0	375° C.
5	400
7	450
10	Above 600 (?)

From these figures, it is concluded that the iron content should not exceed 7 per cent. An analysis of the dust should include the metallic iron. The important thing is the ratio of the metallic iron to the metallic zinc, rather than the percentage of iron to the total dust.

Life tests show that there is a minimum weight of zinc per square inch necessary for good coatings; to test the value of sherardizing, the weight of zinc should therefore be determined. There are various proposed methods for doing this. One approximate way is by the Preece or copper-sulfate test.

A new method depends on the fact that a boiling 10 per cent solution of ammonium chloride removes zinc from sherardized coatings rapidly, but does not dissolve iron until the zinc is practically gone. This test may be applied in two ways: The coating is completely removed and its amount determined by loss in weight; or the weight of the coating is found approximately by noting the time for iron to appear in the boiling solution. At each 5 min. interval a drop of the solution is removed upon a spot-plate and tested with potassium ferriccyanide for the presence of iron. When the blue color appears, the coating is gone, and the time is a measure of the weight of zinc. A good coating should withstand this test for 10 or 15 minutes.

A comparison of short-time rusting tests, such as the salt spray, with tests in actual service, shows that rusting in the short-time tests does not necessarily mean a short life in service. The rapid rusting tests are, however, of value in judging the quality of a coating, when an actual determination of the weight of zinc is made at the same time. These two methods should supplement each other.

Discussion on Experiments with Sherardizing

Mr. Marshall in a written discussion pointed out that Mr. McCullouch's figure of 6 per cent as the least iron possible in sherardized coats could not be considered proof without microscopic and sectional investigations. He also stated that Mr. McCullouch's point that iron and zinc dust were useful was wrong, in his belief, because iron needed a high temperature and added to the flaking and chipping of the coating. He added that stripping in boiling ammonium chloride was not, in his opinion, a good test but believed that iron would come over into the solution before all the zinc was dissolved out.

F. L. WOLF. Marshall found that in sherardizing at 370 degrees centigrade, there were three different layers, while in sherardizing over 370 degrees there were 5 layers. I should like to ask if it is thought necessary to have the zinc in contact with the article to be sherardized?

J. L. JONES. Hot galvanizing is much better in general than sherardizing. The latter is weak and brittle. However, if sherardizing is chosen it should be done with a fine powder containing over 80 per cent metallic zinc and at more than 375 degrees centigrade, as shown in Mr. McCullouch's paper.

MR. STOREY. In my experience it is necessary to have actual contact between the article to be sherardized and the zinc dust. Zinc vapor is not sufficient.

W. H. FINKELDEY. What effect has the size of the particles?

L. McCULLOUCH. We have no data on that point. Our work showed that the point of prime importance was to have the zinc and iron in proper proportions.

F. L. WOLF. In my experience the thickness of the sherardizing coating was not over important. We found, however, that from one to one and one-half ounces per square foot was about the best.

Genelite: An Improved Bearing Alloy

A New Synthetic Bronze-Graphite Bearing Metal*

By E. G. GILSON, Research Laboratory, General Electric Company

All machinery may be classed as a composite of rigid members moving about pivots or bearings. As the industrial world has progressed and developed, the importance of its bearings to any given machine has become more and more emphasized.

These bearings have now become of such importance that it is perhaps safe to say that a large proportion of all machinery is designed around them; and it is usually at the bearings that trouble first develops. A few years ago this relative importance was not so great, and users in general were educated to the belief that bearing troubles were something that could not be helped—therefore must be endured.

However, the greatly increased strength of modern steel alloys created a desire for greater output from a given size machine, and the resulting increase in load and speed between rubbing surfaces intensified bearing troubles and focused attention on the need for better bearings.

In general there were two methods of attacking the problem, viz.: first, to improve the bearing itself either by design or through the development and use of better metals, or both; second, to improve the lubrication of the bearings either by the use of a better lubricant or a better method of applying it, or both.

The new bearing metal Genelite is a distinct advance by the first method.

*From the General Electric Review.

This material is a synthetic bronze of high grade, having uniformly distributed throughout its mass approximately 40 per cent by volume of very finely divided graphite. It is made by thoroughly mixing the finely powdered oxides of the metals composing the bronze with sufficient graphite to completely reduce them and leave in excess of this amount the graphite content desired in the finished material. This reduction process must be carried on at temperatures below the melting point, and therefore the material cannot be cast, as are ordinary bronzes. It is shaped by molding under high pressure while still in powdered form. As the powder does not flow readily under pressure it is necessary to use a complicated mold, and confine this operation to only the simplest shapes.

Although the finished material has the appearance of bronze, it cannot be machined easily by ordinary methods, as it rapidly dulls the cutting tool. It does grind very easily, however, and this has been found to be the most satisfactory way to perform the machining operations.

Genelite has not the physical characteristics of ordinary bronze. It is absolutely "dead" when struck; it has comparatively low tensile strength and elongation, and the ultimate strength and yield point are practically identical at 8000 lb. per sq. in. Under compression however, it will withstand as much as 50,000 pounds per square inch.

These characteristics are explained by the structure of Genelite, which is not like that of the metals or alloys, but is of a porous nature. The best conception of it is perhaps obtained by thinking of a metallic sponge having graphite particles firmly held or clamped within its pores. In this connection it should be remembered that the graphite is so securely held that it cannot escape except by disintegration of the whole mass.

The porosity is such that the material will absorb from 2 to 3 per cent by weight of oil. This feature is well illustrated in Fig. 2, which shows oil being siphoned from the upper to the lower vessel by capillarity through the Genelite block to the wick, and by the wick to the lower vessel. This peculiarity is taken advantage of in some practical applications, as will be mentioned later.

A very marked advantage that Genelite has is that a bearing never seizes, as this term is commonly understood. That is, the shaft and bearing material never weld or flow together, with the consequent disastrous results. This self-lubricating property makes it extremely difficult to damage a Genelite bearing, even though the oil supply is stopped for a considerable length of time. This property makes it possible to operate Genelite with a minimum supply of oil, and it is taken advantage of in many applications, such as in tilting motors, where the standard oil ring practice cannot be used, because the oil will run out of the bearings when tilted. In this case, by providing an oil-tight space or receptacle in the housing on the outside of the bushing, and means whereby the oil is kept in contact with the bushing, capillarity will carry sufficient oil to the bearing surface. Another application of this same sort is on high speed spindles. In such places too much oil is a detriment, and the method outlined above works extremely well. In one place it was found that by using Genelite in this manner the hardened steel shaft that was formerly used could be replaced by a soft steel shaft, the oil consumption reduced over one-half, and the care of cleaning and truing the bearings reduced to nil. This freedom from wear of both bearing and journal in this and many other tests under actual service conditions demonstrates one of the most marked advantages of this new material.

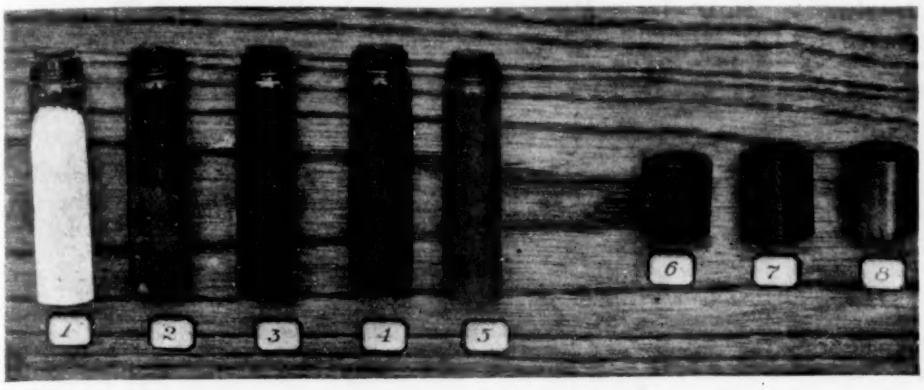


Fig. 1. SOME OF THE STAGES IN MANUFACTURING GENELITE. Nos. 1, 2 and 3, Raw Materials; 4, Graphite; 5, Mixture Ready for Pressing; 6, Bushing, Pressed from the Powder; 7, Bushing after the Final Bake; 8, Finished Piece.

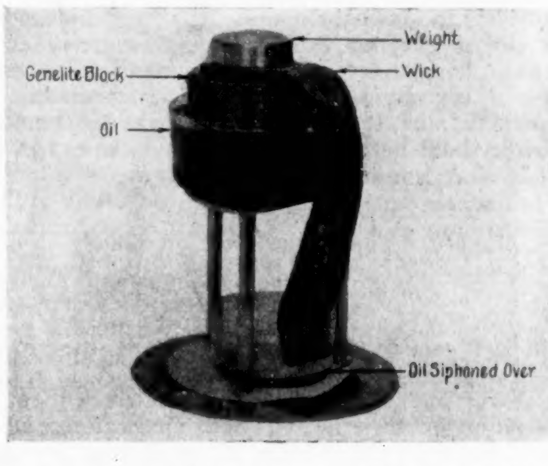


Fig. 2. TEST DEMONSTRATING POROSITY OF GENELITE

Genelite may be used as a self-lubricating bearing in places where such use is a necessity. But applications of this sort should not be compared with properly lubricated bearings; compared with other self-lubricating materials it gives exceptional results.

Owing to its spongy structure it is advantageous to give Genelite a greater allowance for press fits than is customary with other materials; also it need not be held to such close limits. In most applications a greater clearance on running fits is beneficial, and this increased clearance is not productive of noise.

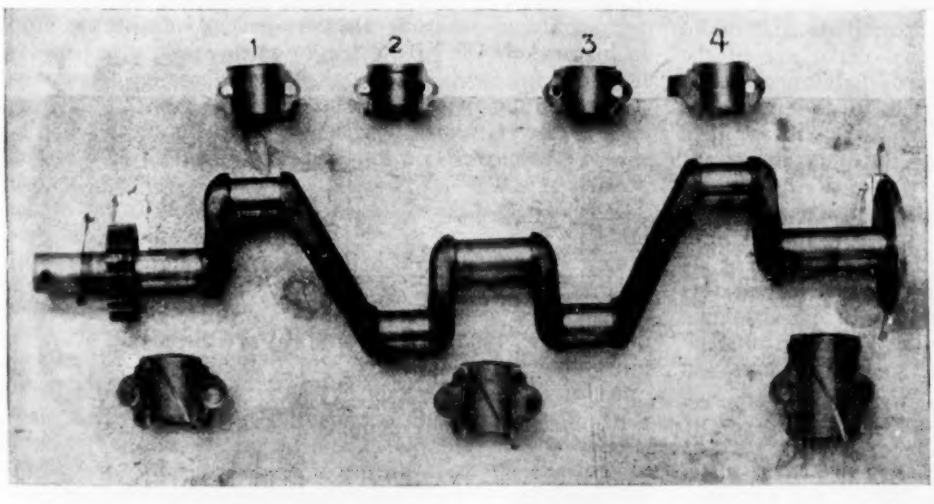


Fig. 3. CRANK PINS AND MAIN BEARING OF AN AUTOMOBILE AFTER 20,000 MILES SERVICE. Connecting rod bearings equipped with Genelite. The main bearings showed decided wear, while the crank pins were barely polished and the connecting rod bearings had not come to a full seat.

Factory Life

Dealing with Shylocks, Lavatory Lizards, Petty Thieves, Chronic Lates, Time Killers, Holiday Boomers, Crap Shooters, Roving Busybodies, Holy Joes, Rummies, and Coke Fiends and Their Relation to Production

Written for The Metal Industry by WILLIAM H. PARRY

Was there ever a factory housing a considerable number of men that did not include at least one busy Shylock among its personnel? This breed still flourishes, and will as long as men are foolish enough to pay the usurious interest demanded by them for cash loans to their less fortunate shop mates.

From twenty-five to one hundred per cent a week is the interest rate usually charged, and while it is almost unbelievable that men will pay it, I know of my own knowledge that such was the case in many instances; in fact the highest rate was charged more often than the lower, as in that particular factory the risks taken by the various Shylocks, showed them to be very game gamblers. They lost both principal and interest frequently enough by the sudden departure of the borrowers for them to doubt the honesty of all factory hands.

To circumvent this evil, the men were notified that they could borrow a reasonable amount of money on the basis of their wages, length of service, character, etc., without any interest being charged by their employers, and while it did not put all of the Shylocks out of business, the more sensible of the men took the offer.

LAVATORY LIZARDS

The number of men who have an unholy desire to spend a lot of their employers' time in the lavatory is a fair percentage of any force, and while I admit that this subject is taboo in all family newspapers, yet it is of serious import enough to be considered by the technical press in its relation to production.

Lavatory lizards are sometimes treated without any consideration for their feelings both physical and mental, as is evidenced by the practice in one shop of forcing all candidates for its accommodations to pass through an office where an eagle-eyed individual presided for the express purpose of timing their stay to such a nicety that at the end of six minutes he turned on a flood of live steam that compelled the hurried departure of the enraged occupants in various states of habilimental distress. Still another concern resorted to the use of a squirt gun of liberal diameter and stroke on those men who were apt to take a little nap as the most important part of their visit. At the factory of one of the biggest automobile concerns in Detroit, where there are more motor cars made in a day than others make in a month, this privy matter is taken very seriously, because of its bearing on production. There is a rule in force at this works, that any absentee of a foreman's crew from his machine or bench due to a visit to the lavatory, must be made good by the foreman himself, so that no break in the continuity is possible.

This **listens** well, but what they do when two or more of the crew are in consultation in the lavatory at the same time, is more than I can figure. In the United States Navy a petty officer is detailed to the unpleasant duty of maintaining discipline and cleanliness of all privies though the term used aboard ship is "The Head." This I consider the best solution of this ever vexing problem; to appoint a monitor whose sole duty is to keep these places clean and report to the foremen on printed blanks the names of his best customers, which would include those who acquire the sleeping sickness after being seated comfortably.

PETTY THIEVERY

Petty thievery is ever present in all shops, large and small, and possibly the worst offender (at least they are so considered by all mechanics) is the tool thief, whose specialty is the theft of his shop mates' tools. They do say that the man who robs the poorbox in a church is a despicable thief, but he has nothing on the tool thief for downright meanness.

Any mechanic will tell you that money will never replace the tools lost by theft, because of that indefinable something akin to affection that exists in the carcass of any true mechanic for the instruments that assist him to make his living.

Again the light-fingered fraternity has a strong leaning toward the non-ferrous metals as a means of realizing spot cash from dishonest junkmen, whose number is legion. I once heard a brass foundry foreman make the statement when charged by his superintendent with not turning out enough castings of a certain type, that they were stealing them from the machine shop faster than his crew could cast them in the foundry.

An investigation proved that this statement, though exaggerated, was not so far from the truth as one would suppose, and on a closer watch being kept on a few members of the machine shop force, "charioteers" and their actions after shop hours, satisfied everybody that all the goods that left the factory did *not* pass through the shipping department.

A singular state of affairs in regard to the theft of non-ferrous metals, is that the practice is not confined to the transients whose stay at any shop is short, but is very apt to include some of the oldest employees, who are unable to offer any reasonable excuse when caught with the goods on them. One case in particular was that of an employee with a record of thirty-six years' service, who confessed that he always carried some brass home in his pockets, and if he forgot to do so on any one day, he made up for his laxity the day following. Assuming that this man pilfered but a pound of brass a day, and that is a very conservative estimate, his grand batting average was over five tons, worth at least three thousand dollars.

While it is impossible to cope with all forms of dishonesty in a factory, experience teaches that it is good policy to clear the departments at the end of the work periods of all employees, and have men stationed near the exits and dressing rooms to prevent their return during the lunch hour, and after the days' work is finished.

In any factory equipped with lockers for the men's clothing, and a room to house them, you can catch many a crook by the simple expedient of "frisking" the outer garments kept there during the work periods, and which are used for storing contraband on its way to the junk dealer. Only be sure that a trusted and honest man does the "frisking" as the first crook may object to being robbed by a crook disguised as an honest man.

LATE COMERS

The chronic late comers are as big a nuisance as the crooks, and set an equally bad example to others. The practice of arriving late day after day is as natural to

some men as eating, with this difference: that they are very prompt at meal times.

It would not make any difference to this class of men if the morning starting time was ten o'clock, for they would be late just the same.

There is only one cure for this crime, pay them off and wish them well, elsewhere.

TIME-KILLERS

The time-killing element is a part of the factory personnel, and to study some of their traits has provided me in the past with lots of amusement.

Just watch how deliberately he walks over to his machine or bench at starting time, how particular he is to don his overalls or apron, just so, taking lots of time to do it, then after a few seventh inning stretches he manages to liberate enough energy to make a stab at the job on tap that day. But not for long, not he, as speed is not his middle name, and the union has ordered him not to work too hard, an entirely unnecessary edict in his case.

I have found this type of mechanic exceedingly vain of his personal appearance, as the main piece of furniture in his tool kit is usually a mirror so placed during working hours that he can locate the boss by looking at it, and just incidentally note any change in the parting of his hair, if he has any. I tried to cure a few of these time lizards, by placing them in the most conspicuous locations, in the hope that they could be shamed into being decent, but gave it up as a bad job.

The only cure for this disease is to give them "the gate."

HOLIDAY BOOMERS

Men who are otherwise perfect, lose all control of themselves when the question is put up to the rank and file as to whether a certain holiday is worth observing by losing a day's pay while enjoying it. The men who can least afford to lose the day's pay are very often the first to advocate and vote for the observance of any old holiday, and anyone with temerity enough to oppose them is scored as a piker.

Let us suppose that the vote on being counted, is overwhelmingly in favor of working on that day, do you suppose that the holiday boomer is downcast? Not on your Victrola. He starts to work on the morning of the fated day, and by noon time at the latest, has induced enough men to quit, so that it would not pay to run the plant for the few who would remain for the rest of the day.

Shooting at sunrise is the only known cure for the holiday boomer.

CRAP SHOOTERS

Crap shooting must be quite an art, and a very fascinating pastime, judging by the number of grown up men who carry the cubed tools on their persons. In fact, there are a great many mechanics who consider a pair of dice as the most profitable tools in their kit-box. I have interrupted quite a few games where the participants have become so engrossed with the game as to forget that there was such a thing as shop discipline.

Once a crap shooter, always a crap shooter, is what the police tell us, so there would not seem to be much hope of curing the disease among shop men afflicted with it. But as the disease is more prevalent on pay day and possibly the day following, a little extra precaution on those days seems to lessen the symptoms somewhat.

ROVING BUSYBODIES

The roving busybody who makes it his business to visit departments other than his own at every opportunity to exchange gossip, is one of the worst pests that infest an otherwise harmonious organization.

He it is, that starts all rumors, mostly untrue, and if there should be a real dearth of news, he sees to it that the void is filled immediately, and goes on his way rejoicing. There is no punishment to fit this crime, except possibly to tie him to his machine or bench, but believe me, he would have to be tied very tight.

THE HOLY JOE

The term Holy Joe is applied to any unfortunate individual whose conception of the duties which his religion imposes on him, is, to attempt to convert his shopmates over to his idea of what constitutes the proper life to lead (at least in machine shops) to insure happiness in the hereafter. This is not a pleasant subject to deal with in the technical press, but, it is important enough to consider as bearing on shop discipline, which the average Holy Joe thinks is something good to eat, judging by the total disregard with which he meekly treats it.

Distributing tracts among shopmates may be productive of much good if the men are a serious minded lot, but as they are not so afflicted, the reading of the tracts is responsible for more profanity and ribald jests than is good for the readers and listeners.

I have met with but three of this type, one of whom was actually sincere, and a splendid mechanic. The other two were insincere mountebanks parading their alleged religion for what it was worth to them. One of these worthies was a Christian Scientist who discoursed beautifully on Mother Eddy's syndicated beliefs during working hours but, he was one rotten mechanic. The third member of this triumvirate had graduated from the Zion City brand of hysteria, and loudly proclaimed his beliefs at any and all times regardless of his employers' interests, but not of his own. His rather hurried departure proved that he owed money to about one-half of the men in his department, to say nothing of a liberal sprinkling of those in other parts of the shop, who foolishly listened to his siren voice.

The only cure for this ailment is to notify the commissioners of lunacy to send a wagon over to the plant to gather up another candidate for the Noodle House.

RUMMIES AND COKE FIENDS

Figures have been published in the newspapers showing the effects of the enforcement (or lack of it) of the prohibition law. In neighborhoods where booze is scarce and money is scarcer, it seems to work out pretty well, but that does not apply to Brooklyn, N. Y., as whiskey is easily procurable if you have the price, in that town.

Hootch sells in Brooklyn at twenty-five to one hundred cents a drink, depending on its shocking qualities, and the gullibility of the victim. That the victims are many is evidenced by the aroma ever present in factories, particularly for the first hour after the whistle blows in the morning. In the old days, when bar whiskey sold for "ten cents a whole lot" nothing was thought of going to work with two or three drinks of the vile stuff under the belt and getting away with it day after day, but nowadays, one drink of the fusel oil, wood alcohol, French spirits, or whatever it is they call whiskey, is self advertised to a remarkable degree, in that the drinker smells to high heaven, and his actions are such as to create the impression that a piece of lead pipe was wrapped around his head rather forcefully at the time he had indulged in the single drink.

How any mechanic can fall for and pay the prices asked for the high powered drinks of today, is more than I can figure. Yet many of them are doing that

very thing and flirting with sudden death and blindness as a consequence. There is no antidote for this state of affairs, and we shall have to await the day when King Alcohol is dethroned never to reign again, which will be in another thousand years or so.

The laws prohibiting the sale and use of narcotic drugs is fairly well enforced in New York State, but the infractions are numerous in certain localities where young men who lack concentration foregather.

My introduction to this form of vice began when I noticed a fine looking young planer hand, apparently making faces at some imaginary foe, and taking plenty of healthy swings at the atmosphere where the foe ought to have been. A hurry call for an ambulance brought a young "cemetery filler" who pronounced the young man **a coke fiend,** gave him a hypodermic injection and bundled him into a stretchermobile.

Thirty days later this young man was discharged from the hospital as cured. He was allowed to start on his old job, and lasted about two weeks, when his foreman noting his absence from his planer, with the machine going full blast, found him perched on top of the super's office, fighting the same old foe in the same old way.

Whether this form of vice was epidemic at that factory only, I am unable to say, but the practice became so prevalent that a notice was placed on the bulletin board to the effect that any employee displaying evidence of being a coke-fiend, would not only lose his job but would land in the "hoosegow" as well.

There is this to be said for those afflicted with this disorder, and that is, they don't stay in any one shop long, as every one of them lacks concentration and application, thus distributing his talents over a wide field. The doctors say that there is no cure for this disease, because only perverts and degenerates are its victims, who become incorrigible in a short time.

It would seem from this report that the science of eugenics if adopted and practiced would offer the only hope for its eradication.

Tests on Electric Furnaces in England

A month's test was recently conducted to determine the utility of a Baily one-ton nose tilting type furnace in one of the oldest brass rolling mills in England. The test charges consisted of cartridge shells and rolling mill scrap, pouring 60-40 brass into round billets, strip moulds, and condenser plates. Allen Everitt & Sons, Limited, of Birmingham, at whose plant the test was conducted, ordered a second furnace of larger hearth to operate with the initial 105 K.W. unit. The first furnace has been in regular service at this plant melting pure copper; the second unit will operate on copper zinc alloys. Both units are arranged to pour the metal directly from the furnace into rolling mill moulds without the use of intermediate ladles.

OPERATING SHEET ON 105 K. W. BAILY ELECTRIC FURNACE OF NOSE TILTING TYPE.
CHARGE CONSISTS OF CARTRIDGE SHELLS AND ROLLING MILL SCRAP POURING 60–40 BRASS INTO ROUND BILLETS FROM 3"–6" DIA. 4' LONG FOR PIERCING.

CONTINUOUS OPERATION.

Date	No. of Heats	Lbs. per Heat	Time of Operation	Nos. of Hrs. Operating	Total Time Required for Charging	Total Time for Pouring	Total Time Melting	Total Metal Melted in lbs.	Melting Rate in Lbs. per Hr.	K. W. Hrs. Consumed	K. W. Hrs. per Ton
9–28 to 9–29	10	1,568	6.30 A.M. to 4.35 A.M.	22 Hrs. 5 Min.	1 Hr. 40 Min.	3 Hrs. 52 Min.	16 Hrs. 30 Min.	15,680	948	2,213	282
9–29 to 9–30	10	1,568	5.05 A.M. to 5.00 A.M.	23 Hrs. 55 Min.	1 Hr. 40 Min.	3 Hrs. 50 Min.	18 Hrs. 25 Min.	15,680	849	2,412	308
9–30 to 10–1	11	1,568	5.30 A.M. to 7.30 A.M.	26 Hrs.	1 Hr. 50 Min.	4 Hrs. 10 Min.	20 Hrs.	17,248	863	2,780	322

Total number of heats 31
Total time melting .... 49 Hrs. 58 Min.
Total metal melted .... 48,608 lbs.

Ave. lbs. melted per hour 972
Total K. W. Hrs. consumed 7,405
K. W. Hrs. per ton metal melted 306

OPERATING SHEET ON 105 K. W. BAILY ELECTRIC FURNACE OF NOSE TILTING TYPE.
CHARGE CONSISTS OF CARTRIDGE SHELLS AND ROLLING MILL SCRAP POURING 60–40 BRASS INTO STRIP MOULDS WEIGHING 125 TO 175 LBS.

CONTINUOUS OPERATION.

Date	No. of Heats	Lbs. per Heat	Time of Operation	Nos. of Hrs. Operating	Total Time Required for Charging	Total Time for Pouring	Total Time Melting	Total Metal Melted in lbs.	Melting Rate in Lbs. per Hr.	K. W. Hrs. Consumed	K. W. Hrs. per Ton
10–3 10–4	10	1,668	6.25 A.M. 5.50 A.M.	23 Hrs. 25 Min.	1 Hr. 40 Min.	1 Hr. 40 Min.	20 Hrs. 5 Min.	16,600	830	2,575	308
10–4 10–5	11	1,668	6.15 A.M. 4.50 A.M.	22 Hrs. 35 Min.	1 Hr. 50 Min.	1 Hr. 50 Min.	18 Hrs. 55 Min.	18,348	965	2,471	270
10–5 10–6	13	1,668	5.15 A.M. 6.00 A.M.	24 Hrs. 45 Min.	2 Hrs. 10 Min.	2 Hrs. 10 Min.	20 Hrs. 25 Min.	21,684	1,060	2,934	270
10–6 10–7	12	1,668	6.20 A.M. 5.30 A.M.	23 Hrs. 10 Min.	2 Hrs.	2 Hrs.	19 Hrs. 10 Min.	20,016	1,040	2,752	275
10–7 10–8	13	1,668	5.50 A.M. 7.25 A.M.	25 Hrs. 35 Min.	2 Hrs. 10 Min.	2 Hrs. 10 Min.	21 Hrs. 15 Min.	21,684	1,020	3,028	280

Total number of heats 59
Total time melting .... 99 Hrs. 50 Min.
Total metal melted .... 98,412 lbs.

Ave. lbs. melted per hour 985
Total K. W. Hrs. consumed 13,760
K. W. Hrs. per ton metal melted 280

Furnace was shut down two days to change casting table before this run.
Power required to heat furnace before charging after two days' cooling .... 940 K. W. Hrs.
Power required for melting 98,412 lbs. of metal .... 13,760 K. W. Hrs.

Total power consumption melting and preheating furnace .... 14,700 K. W. Hrs.
Power consumption per ton including preheating of furnace after two-day shut down .... 299 K. W. Hrs.

The Metallurgy of Tin

A Treatise on the Modern Methods of Smelting and Refining of Tin

Written for The Metal Industry by WALTER H. JACOBSON,
of the Tottenville Copper Company

DIFFICULTIES OF TIN SMELTING

The smelting and refining of tin in this country has increased twofold within the last six years. Heretofore we depended upon shipments from China and the United Kingdom for our commercial use. In 1915 the American Smelting & Refining Company constructed a tin plant and installed the only electrolytic process of tin refining in the world. Much is to be said in favor of such a process. Aside from the introduction of refining by electrolysis very little has been contributed to the metallurgy of tin within the last twenty years. The paramount problem of removing iron from the ore as yet remains unsolved. The writer has laboriously worked on the proposition using all possible leaching agents and the electrostatic separator with very little profitable success. It is true that most of the iron is removed by subjecting the ore to a thorough roasting, thereby converting the iron compounds into the oxide and leaching the residue with hydrochloric acid. However, the costs involved in such a process would, no doubt, outweigh the advantages. It is the iron of the ore which offers a huge handicap to profitable smelting due to the formation of alloy or "hardhead," a complex combination of Fe_4Sn, Fe_2Sn, and $FeSn_2$. Moreover, if the ore were free from iron, only a single smelting process would be necessary,—in which maximum reduction could be effected and clean slags would be formed.

PROPERTIES OF TIN

Tin with a specific gravity of about 7.41 has a blue white color. It is malleable but less ductile—its tensile strength being about 4,590 pounds to the square inch. At about 200 degrees Centigrade (32 degrees below its melting point) tin has a tendency to become brittle and thus be pulverized very easily. At low temperatures an allatropic modification is indicated. The metal under such conditions is transformed into a gray granular powder with the specific gravity of 5.91. This phase is usually termed "Tin Sickness." Its boiling point is about 2200 degrees Centigrade—volatilization beginning at about 900 degrees. At normal temperatures tin is very slightly effected by the oxygen of the air; at higher temperatures it oxidizes very easily and has a strong affinity for sulphur, arsenic, iron and antimony.

SOURCES AND TYPES OF TIN

The natural sources of tin are very unlike that of copper; 99 per cent of the tin ore is in the form of the oxide, SnO_2, or cassiterite. The cassiterite or tin-stone is very easily separated from the gangue and concentrated due to its high specific gravity. In this form the ore with a tin content of 50-65 per cent is handled at the smelters. Tin is also recovered from tin plate clippings which consists of iron sheets coated with tin. This production is so small that the principle of such a process will not be considered in this article. Many plants also buy tin drosses or liquation drosses. This material is very easily smelted in a reverberatory furnace—being reduced with coal and fluxed accordingly.

The nature of the ore to be smelted varies with the process to be used. Comparatively pure ores are smelted without previous roasting in a reverberatory with the production of a high grade tin. The analysis of a good ore which does not require preliminary treatment and yet forms a good product is as follows:

SN	SIO_2	FE	CAO	S	PB	CU	BI	AS	SB
60	2.5	4.1	0.1	0.11	0	0	0.02	.02	.03

Impure ores require a thorough roasting before smelting and the tin product usually about 96 per cent pure is refined by liquation and tossing or preferably by electrolysis. An impure ore runs high in either sulphur, bismuth, lead or antimony. The Lallagua brand from Bolivia is classed as impure and assays as follows:

SN	SIO_2	FE	CAO	S	PB	CU	BI	AS	SB
67	2.8	4.6	0.2	3.31	.03	.04	1.01	.03	.04

PRELIMINARY TREATMENT

The ore, on reaching the smelter, is first crushed in a ball mill and screened to 15 or 20 mesh. These machines have a revolving cylinder where the ore is pulverized by the grinding and cutting of steel balls. During the operation the small particles of ore fall through the desired size screens; the oversize are deflected to the grinding center and finally ground to the normal mesh. The screenings are then delivered by means of an elevator to the hopper of a 5 hearth wedge Mechanical Roaster. During this operation the sulphur and some arsenic are eliminated in the form of sulphurous and arsenious anhydrides. After passing through the roaster the charge drops into a car and is delivered to the regular designated ore bins.

The next and by far the most vital process is the smelting of the ore itself. To successfully smelt tin ores requires the service of a metallurgist who is thoroughly acquainted with the various practical and theoretical applications. Profitable smelting is only effected by producing a good tin with the least possible loss in the formation of alloy, fume, matte and slag. Ore is smelted in either the reverberatory or the blast furnace.

REVERBERATORY SMELTING

Reverberatory furnaces are constructed according to their requirements. The first problem is the capacity of the hearth that is essential for economical smelting; the second is the necessity of effecting a temperature sufficiently high for smelting. Temperature conditions of the furnace are entirely regulated by the calorific power of the fuel, by the correct proportioning to the hearth of the apparatus used for burning the coal and by the appliances for furnishing the needed oxygen of the air and for withdrawing the products of combustion. For a given temperature the hearth area must stand in a certain ratio to the grate area. Usually, for tin smelting, assuming the grate area to be 1, the hearth area should be 6 to 6.5. The main reactions in this form of smelting are the reduction of the oxide of the ore by the coal and the formation of an iron—calcium—silicate slag.

$$SnO_2 + 2C = Sn + 2CO$$
$$xFeO + yCaO + zSiO_2 = 4RO, 3SiO_2$$

The reducing action of matte and alloy are also important.

$$2FeSn + SnO_2 = 2Sn + 2FeO$$
$$SnS + SnO_2 = 2Sn + SO_2$$

The metallurgist figures on getting a slag with a low formation temperature and of the proper type to effect a good reduction. If the slag is too fusible, a reasonable reduction is not accomplished; if infusible, it freezes the furnace. Accordingly, the most efficient solution lay in the intermediate stage of these limits. Some smelters prefer a singulo silicate slag; the writer, however, has obtained more favorable results with the sesqui-silicate type slag in which the ratio of the oxygen of the base to the silica is as 2 to 3. Reverberatory smelting, though slower than the blast furnace, produces a better grade of tin in that reduction is not so strong. The main advantage of the slow production is that the fine material can be smelted without preliminary treatment such as briquetting or sintering. The matte prduced is roasted and added to the regular smelting charge, while the alloy is also blended into the ore charge and treated in the same way. When alloy is on the charge, the reduction factor must be carefully considered or the same amount of alloy will be formed as was added to the original charge. If the slag should have a tin content of 10 per cent or above, it is usually smelted with lead dross with the production of solder, or it is added to the blast furnace charge. Slags assaying about 5 per cent tin are poured in a molten condition in slag-settling furnaces where the greater amount of SnO dissolved in the slag is reduced with carbon or iron with the formation of some tin and alloy. The resulting slag is discarded as it normally has a tin content of 1.8 per cent.

BLAST FURNACE SMELTING

If tin is to be refined electrolytically, it is customary to have a blast furnace for the rapid production of metal for anodes. The type in use in tin smelting is a modern water-jacketed furnace about 25 to 30 feet high. A cupola might be used, but due to the shortness of the ore column a very good reduction can not be accomplished. The blast furnace, as many say, is the metallurgist's puzzle. A careful supervision is required at all times, to govern the proper type slag to be formed, to regulate its operation so as to prevent the choking of any of the tuyeres, to effect the desired reduction and, in short, to get maximum metal with the minimum tieing up of tin in the form of slag, matte, alloy or fume. Each blast furnace is connected to a bag-house or a Cottrell system where the tin is recovered in the form of stannous and stannic oxides. During normal smelting 2 to 3 per cent of the tin is volatilized. This fine product assays about 55 per cent tin and can easily be re-treated in the reverberatory or the blast furnace.

Before adding the main charge preliminary steps are necessary. The brick-work that is exposed to high temperatures is slowly heated to drive off any moisture. This warming process requires a treatment of several days. Little coke is added for a few hours after which a small amount of slag is included. At this stage the blast is turned on with a pressure of one ounce per square inch. When a little fusible slag is formed, the regular charge is mixed in with the slag and coke. The blast is accordingly increased to a pressure of three ounces and held for about six hours, when the regular charge is added in the regular amounts. The normal pressure varies from thirty-two to thirty-eight ounces—this depending upon the rate of driving the furnace and the tightness of the charge.

The blast furnace charge is normally made up of sintered material. This process agglomerates the fine material into a hard compact porous mass which is ideal for smelting. The weighed charge is dumped into a concrete mixer and conveyed by means of an elevator equipped with scoops to the hopper of the sinter. The lime-rock besides acting as a flux and a binding agent serves the very important purpose of combining with any sulphur to form calcium sulphate thus minimizing the formation of tin matte. When the sinter is thoroughly prepared it is wheeled and dumped into charge cars where the required amount of coke is added. This completes the preliminary treatment of the material which is now added to the blast furnace.

The blast furnace reactions are similar to those of the reverberatory, although more complex. There are usually four zones through which the charge descends; peparatory heating, reduction, fusion and combustion. In the first moisture and volatile matter are driven off into the flue. In the reduction zone carbon and carbon monoxide act upon all metallic oxides. In the third zone the reduction is more completely carried on and in the zone of combustion the blast comes in contact with the burning coke which furnishes the heat and atmosphere necessary for the process. The iron is oxidized and readily picked up by the silica with the formation of slag. The slag in the fluid condition trickles down with the metal thus forming two layers. The slag with a lower specific gravity settles on the top and the metal on the bottom. If the slag is high in tin, it is granulated and re-smelted; if low in tin it is transferred to the slag settling furnaces where most of the tin is recovered. The metal usually about 96 to 97 per cent tin is cast into anodes and sent to the electrolytic refinery.

ELECTROLYTIC REFINING

The electrolytic process, though worked on a commercial basis, has room for further development. With the exception of the electrolyte the electrolysis is carried on in a manner similar to copper. As this is a patented process, the writer is not at liberty to divulge any secret information; however, the principal parts will be mentioned. The electrolyte consists of stannous fluosilicate with enough sulphuric acid to effect the precipitation of lead as lead sulphate. Bismuth, copper, arsenic, antimony, gold and silver remain for the most part insoluble and fall to the bottom of the tank in the form of slime. The efficiency of this process is largely governed by the temperature of the electrolyte, the voltage, the current density and the nature of the deposit. A rise in temperature within certain limits has a tendency to increase the conductivity and the voltage is usually dependent upon the nature of the anode. If a film of basic stannous sulphate tends to form on the anode, the voltage will rise, thus making the electrode somewhat insoluble with the equivalent loss of current. Likewise if the deposit should become stringy, short circuits set in which also decrease the efficiency. Theoretically one ampere hour deposits about 2.212 grams of tin or to deposit one pound of tin about 205 ampere hours are required. In practice 250 to 270 ampere hours are necessary. At present the multiple system of electrolysis is used. The anodes usually assay as follows:

SN	PB	CU	AS	SB	BI	
96	1.03	.59	.12	.12	1.90	with small amounts of Au and Ag.

These anodes and pure tin cathodes are connected in multiple and suspended in oblong tanks with the hereto-fore mentioned electrolyte. The current of required strength passes from the anodes through the solution to the cathode. Tin is dissolved from the anode in the form of stannous ions Sn^{**} which migrate to the

cathode and give up their charge and deposit on the cathode. The lead in the anode is slightly dissolved but is immediately precipitated by the sulphuric acid present. The other impurities fall to the bottom of the tank as slime. The tin content of the electrolyte is never allowed to fall below 2 per cent, for if the solution is impoverished with tin the deposit becomes less pure and less adherent.

Normally the tin content of the electrolyte is about 3.5 per cent stannous tin and .30 per cent stannic tin. The temperature usually ranges between 85 and 90 degrees Fahrenheit. The temperature factor is very vital as it effects uniform corrosion of the anode with the production of a soft film of slime. During winter months it is therefore a difficult problem to maintain continually a constant temperature. Circulation of the electrolyte must be kept at a uniform rate or stratification will quickly take place. At the anodes where tin goes into solution, the electrolyte is heavier than at the cathodes where the tin goes out of solution and due to the different specific gravities present, various strata of solution form. The current passing mainly through the heavier solution dissolves the anode unevenly and deposits tin irregularly. The rate of circulation depends therefore upon three factors: current density, temperature and the purity of the anode. Too rapid a circulation is very detrimental in that the insoluble material will not settle at the bottom of the tank. Under such conditions minute particles will be occluded in the cathode deposit with the production of a poorer grade of tin. Running at a current density of about 9 amperes per square foot, the anodes and cathodes are removed from the tanks by overhead electric cranes at periods of seven days. The cathodes are melted in a huge kettle and cast into bars or ingots for shipment.

The average analysis of such a tin product is as follows:

SN	PB	CU	BI	AS	SB
99.96	.002	.013	.022	.001	.002

The slimes which are rich in bismuth with a large amount of silver are shoveled from the bottom of the tanks and treated in a way to separate and concentrate each metal constituent of the slime.

Oil Furnace Operation

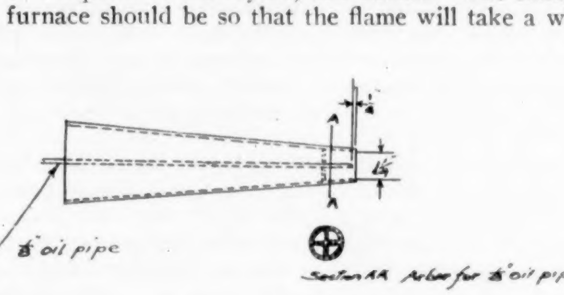
By W. J. REARDON, Foundry Editor

Q.—I am in charge of a foundry operating a 42" class "D" Hawley Schwartz Furnace and I am taking the liberty of writing you to see if you could assist me to overcome some difficulties. In the first place, we purchased this furnace second hand, all ready to operate. We are using a No. 1 Root Blower. This gives a blast pressure by open mercury gauge of about 22 oz. We are using what is called here gas fuel oil. This oil is very thin, in fact it is almost as liquid as coal oil. We operate under a pressure of 45 lbs. in our oil system. Our trouble seems to be to get away from oxidized metal and smoky flame. We are making bronzes of alloys 85 Copper, 10 Tin, 5 Lead. Every casting we have turned out has proved defective, a certain amount of slag remaining in suspension. This I believe has been chiefly due to our failure to raise the temperature of the metal to above 1,800 degrees F., which we tested with a Taylor Pryometer. We have also considerable trouble with our slag, in fact the bottom of the furnace is gradually filling up. We have tried fluorspar, lime, various fluxes and also bottle glass and anthracite peat coal but we have never tried poling the metal. In operation we preheat our furnace by running empty for approximately 45 minutes, we then charge our copper wire which is put in crucible form, we then adjust our furnace so that the flame is of yellow color for a short period, after which we cut down our flame until it is almost transparent at the spout, small tongues of flame only showing. It is at this stage that we use our pressure of 22 oz. of air to the full and yet we are unable to bring this metal to above a temperature of 1,800 degrees F., our furnace never being more than a bright red color.

I have noted a sketch of yours in THE METAL INDUSTRY of recent date, showing an arbor for oil feed pipe. I am having this arrangement put in our tuyeres and am hoping to get better results. I shall be pleased if you can offer me any suggestions as I am very anxious to bring this furnace up to a point of efficiency in operation.

A.—In operating the Schwartz Furnace I had no results with the Class "D" furnace, as the tuyeres are set too high in the furnace. The change I made in the furnace was to drop the tuyeres down, I believe, about six inches. This furnace is called the class "B" furnace.

If you are making slag in your furnace, your operating conditions are not correct. The first thing that is necessary is to see that you have at least 18 ounces of air pressure, and at least 25 lbs. of oil pressure. This you seem to have. Second, it is necessary to see that your tuyere points are not burned, so that the opening is not larger than 1¼. Third, see that your oil pipe is ⅛" and run to the point of the tuyere, like sketch. The lining of the furnace should be so that the flame will take a whirl-



A GOOD OIL BURNER

ing motion. In my experience with the Schwartz furnace, I considered the lining of the furnace to be of the most importance. The furnace should be clean and free from slag at all times. If you attempt to melt metal in a furnace where the bottom is built you can not get the combustion. The proper combustion is what I call a neutral flame, where there is enough air to burn all the oil. If your furnace smokes, look after your oil pipe. If you put the arbor in the tuyere to hold the oil pipe, there is no danger when the pipe becomes hot and lags over to the sides, which causes the furnace to smoke.

The best flux that I found to keep the furnace clean, is fine coke dust. A shovel full added to a 500-pound charge will clean your furnace. The fact that your metal is not above a temperature of 1,800, shows clearly that you are not getting the combustion.

I have melted as high as 500 pounds every twenty minutes in a Class "B" furnace, changed as I have described. Forty minutes with 18 ounces of air and 25 pounds of oil pressure on Red Brass should give you a temperature of 2,200 degrees Fahr.

Meeting of the New York Platers

A Report of the Meeting and Annual Banquet of the New York Branch, American Electro-Platers' Society, on February 18, 1922, Called Founder's Day

The annual banquet of the New York Branch of the American Electroplaters' Society was held at the Aldine Club, 200 Fifth Avenue, New York, Saturday, February 18, 1922, called Founder's Day in honor of Charles A. Proctor, founder of the society, and plating chemical editor of THE METAL INDUSTRY. The committees were as follows:

Publicity: H. C. Flanigan, William Voss, Ben Popper, Joseph Haas.

Printing: William Voss, John J. Burke, H. C. Flanigan, G. W. Wilson.

Banquet: Thomas B. Haddow, H. C. Flanigan, J. Sterling, T. Stretch, William Voss, Ben Popper, A. Ginham, A. D. Havens, William Fischer.

The ladies had charge of the entertainment.

The banquet was the most successful ever held by the New York Branch; the ladies did excellent work in arranging the diner and entertainment. The technical session was of great interest and value.

Mr. Stremel opened the meeting and introduced Mr. Proctor, who delivered an address on "The Spirit of Co-operation." He then opened the meeting to technical papers and discussions.

Experiments on the Electro-Deposition of a Heavy Copper Deposit —From the Cyanide Solution

By C. J. WERNLUND

When the writer was assigned the problem of plating one-fourth inch of hard copper upon steel, the cyanide solution seemed the only alternative. A survey of the literature in this field, however, made one feel much as Ostwald did upon receiving, on the same day, "Arrhenius's dissertation on electrolytic dissociation, a toothache, and a nice daughter." As the Swede put it, "That was too much for one day."

For instance, speaking of copper deposits, Mr. George B. Hogaboom[1] states, "Wherever heavy deposits are required they are put in the acid bath."

In C. W. Bennett's[2] résumé of copper plating solutions we find eighteen different copper cyanide solutions reviewed. A study of these formulas shows three classes of ingredients common to all, namely: alkali copper cyanide, conducting salts and water.

With the above mentioned fundamentals in mind and realizing that simplicity of a plating solution is its greatest asset, the following solution was gradually evolved, as the simplest workable formula obtainable in practice:

Water	1 gal.
Copper Cyanide (70%)	4 ozs.
Sodium Cyanide (96%)	6 ozs.
Sodium Carbonate (68%)	2 ozs.
Sodium Sulfite	¼ oz.

The following experimental conditions were maintained in making the 5/16" thick deposit here shown:

Temperature	40-50 deg.C.
Current	4-6 volts
Current Density	50-100 Amp/SF.
Area of Anodes	24 sq. in.
Area of Cathodes	8 sq. in.
Rate of stirring solution	75-100 R.P.M.
Total time of plating	130 hours.

Concentration of free sodium cyanide maintained at from 1.5 to 2 ozs. per gallon.

[1] Hogaboom, T. A. E. S. Vol. 23, p. 268 (1913).
[2] Bennett, T. A. E. S., Vol 23, pp. 233-260 (1913).

DISCUSSION OF THE ELECTRO-DEPOSITION PROCESS

In order to speed up the process, as much as feasible, the solution was agitated and used hot. Under these conditions an excellent hard copper deposit was obtained, providing the free sodium cyanide concentration was not allowed to go much lower than 1.5 oz./gal. This verifies Bennett's[4] statement that a hot solution required more free cyanide than does a cold one.

APPLICATION OF THICK CYANIDE COPPER DEPOSITS

The deposits produced from the above solution are characterized by an unusually fine grain structure, together with unusual hardness (scleroscope hardness 35-40). Upon these points Dr. William Blum[3] of the Bureau of Standards comments as follows: "It is well known that copper deposited from a cyanide solution is much finer grained than that from the sulphate solution." Accordingly, in one experiment layers of copper from a cyanide solution were interdeposited between the layers from the sulphate solution. The structure of the "sulphate copper" deposits is affected in just the same way, but not to so marked a degree, by the layers of "cyanide copper" as by nickel. No tensile strength tests were made on this deposit, but there is no reason to doubt that the change in structure was accompanied by an increase in strength.

DISCUSSION

DR. MADSEN. Why was the cyanide solution adopted, in view of the large commercial development of acid copper for heavy deposits in the phonographic industry?

DR. WERNLUND. The general reason, Dr. Madsen, was the point of hardness. The copper deposit from the sulphate solution chipped where rotation was used and that was found unsuitable in the case in question.

DR. MADSEN. Did you make any determination of the cyanogen or cyanide loss due to the elevated temperature?

DR. WERNLUND. The total cyanide or rather the free cyanide was analyzed from day to day and was probably not over 1/5 ounce per gallon. At least it is in that neighborhood. A small amount of free sodium cyanide is required every 10 to 20 hours, depending upon the temperature maintained.

MR. GEHLING. In regard to the expense of plating in cyanide solution, the cost per pound of that material is always high. Did you not find it too high? Cyanide is very expensive.

DR. WERNLUND. The expense, of course, must be high. In this case there seemed no other way to get the hardness in the copper we required. The expense was not too much. The hardness was the primary object.

MR. PROCTOR. If there is no further discussion, we will now listen to a paper by Mr. George B. Hogaboom, who needs no introduction. Mr. Hogaboom.

Amperes Per Square Foot—Faraday's Law

By GEORGE B. HOGABOOM

According to Faraday's Law one ampere flowing through a solution will deposit a certain amount of metal. That is called the "electrochemical equivalent." There were quite a number of remarks brought out by a statement by Mr. Lovering that Faraday's Law was wrong,

[3] Blum, T. A. E. S., Vol. 40, pp. 137-146 (1921).
[4] Bennett, T. A. E. S., Vol. 23, pp. 233-260 (1913).

that he had exceeded Faraday's Law, and that he was in a position to prove it.

He claimed that he had done work at the Cass Technical High School in Detroit, and he found he could obtain a greater amount than Faraday's Law would have given him. It was exceedingly interesting and caused much comment among platers. We thought it would be of value to carry on just a few rough experiments to find out whether Lovering or Faraday was right. Of course, we believed strictly that Faraday was right, but we wanted to find out wherein lay Lovering's error.

We took two litres of standard nickel solution. There seems to be less change in a nickel solution than in cyanide solutions and therefore we got better results and more accurate readings. We had the solution connected with a voltmeter and an ammeter in the line and the time averaged between 35 and 40 hours. We used 4 square inches of cathode surface and 4 square inches of anode surface, being careful to coat the back of the anode with an insulating material, so that we had no current from the back of the anodes. We had two anodes.

After this was run we carefully marked off the surtace in square inches. We had measured the brass very carefully and we marked the square inches, to figure from that what the deposit would be, therefore what the electrochemical equivalent would be and whether or not Lovering was right.

I would like to say here, to criticize some of the statements that were made, that I think it is only fair, when speaking of a man of Faraday's standing, the Electroplaters' Bulletin should not publish statements in such language as it did. It is especially wrong to call Faraday "Mike." I believe that a man who has done as much as he has for electrical science and the world deserves more than to be called by a nickname.

Now the anode and cathode surfaces were set so that we had an exact and unvarying distance between them, and the current was kept constant.

We got a wide variation of deposit over different parts of the cathode. Now, the total theoretical amount of deposit that should have been on that surface was 75.4189 grams. The actual weight was 72.959 grams, showing a little over 97 per cent efficiency.

On some areas we exceeded Faraday's Law; on others we had less than Faraday's Law. Therefore amperes per square foot do not mean anything unless you know what you are plating. If Lovering had any irregular surfaces or edges, his cathode surface was greatly increased and his distances between anode and cathode surfaces varied, throwing his results far off.

It was interesting to see that in an agitated solution (75 p.m.) the deposit on top was heavier; in the still solution the deposit on bottom heavier. Usually the reverse is the case.

In order to test the weight of depositions on different levels of solution, we took for a cathode a strip of brass which extended thirteen inches down into the solution, using an anode fourteen inches long. The cathode was continuous over the rod to which it was connected, there being no wires used. After the metal was deposited, the cathode was treated, stripped and weighed. The results obtained showed a heavy deposit at the top, light toward the center and heavy at the bottom.

As a matter of interest, we tried another experiment. We took a large number of cylindrical shaving soap boxes about three inches long and about one and one-eight inches in diameter.

These boxes had to be plated inside and out. They had to stand knurling, lettering and coloring after buffing. We plated five boxes, in one experiment, and staggered them in the solution.

The nickel was then removed by a reverse current and titrated in order to get our results quantitatively and to obtain a true chemical determination of the weight of the deposit. In order to be more accurate we satisfied ourselves that there was no nickel in the brass originally. The deposits obtained show as wide a variation as the work on the strip.

This showed that wide variation occurs in a solution and the danger of taking any one of these five boxes and using them to calculate against Faraday's Law.

It will be particularly interesting for the members to know the comparison of anode and cathode surfaces in our regular commercial plating solutions for this work. In one tank were placed 1152 boxes having an area of 248 square feet. The racks for these boxes have an area of 400 square feet, giving a total cathode area of 648 square feet. We plated these at 180 amperes at two volts for thirty minutes. Our anode surface totalled only 33 square feet, and we got excellent results. This is particularly interesting in view of the fact that it is generally accepted throughout the plating industry that the anode and cathode areas must be approximately the same.

Mr. Proctor. Mr. Hogaboom has presented a very interesting paper. We are now open for discussion. I would like to know what the analysis of the solution was after thirty minutes' plating with number of boxes used and the total square inches of anode surface used. Presuming that the solution was made up of a certain amount of metal, how much reduction took place?

Mr. Hogaboom. We ran a solution by analysis with approximately 3 ounces of metal per gallon. We have 420 gallons of solution per tank. Running the soap boxes the entire week, we added 6 to 7 pounds of single nickel salts per week.

Mr. Proctor. I don't think we understand nickel plating yet. It shows that an investigation of nickel anodes surface, if such is the case, would be well worth while. Much investment in anodes could be saved.

Mr. Faint. Mr. Chairman, I should like to ask Mr. Hogaboom whether this is a straight single salt solution.

Mr. Hogaboom. We started off with single salts and 10 per cent double salt. We had no additional agent, or anything of any kind. The chlorine content will approximate between 1 and 1½ ounces per gallon. With analysis three times a week, plotting a curve we have averaged, running, 8 pounds of nickel salts per week.

Dr. Madsen. I would like to ask what is the analysis of the anodes?

Mr. Hogaboom. The anodes were purchased upon the open market from a very reliable concern and the anodes average between 96 to 98 per cent; above 96 and never more than 98 per cent; cast anodes, containing the balance in carbon and iron.

Mr. Gehling. Thirty-three square feet in a tank looks pretty small. What size was tank?

Mr. R. E. Johnson. Tank was 7¼ feet long by 4 feet wide with 26 inches of solution. There were 50 anodes in the tank. The anodes were made to our special shape which is nearly elliptical.

Mr. Gehling. If you take 12-inch anodes to make 33 square feet, 33 square looks small there. You probably had 3 rows of anodes in the tank.

Mr. Hogaboom. An anode 12 inches long, 1½ inches in diameter, would not have 144 square inches. It takes several to make 144. I speak of 12-inch anodes, elliptical; 60 square inches. You take 50 anodes like that and you find we were accurate in that measure.

Mr. Wilson. Even when maintaining the anode surface up to the cathode surface, you have to use a certain amount of nickel salts in solution. What was the efficiency of your solution?

MR. HOGABOOM. It would be difficult for us or anyone to compute exactly what the efficiency of his solution is, for the simple reason that the work is wet with water when you put it in, and wet with solution when you take it out. Therefore, to figure just exactly what your anode efficiency and cathode efficiency would be you would have to rinse with distilled water and titrate. I believe it would show that our anode efficiency was quite high.

DR. WERNLUND. Mr. Hogaboom's paper is interesting as regards the throwing power of nickel solutions.

MR. HOGABOOM. On throwing power I know nothing. Some work has been done on that. We have found it a very contrary condition. Solutions that had the highest conductivity had the lowest throwing power. There is no relation between the conductivity and throwing power. We cannot say a thing; we can't even hazard a statement.

DR. MADSEN. I would like to make a few points on Mr. Hogaboom's paper.

I agree most thoroughly with Mr. Hogaboom in the discussion concerning Faraday's Law. One of the things I observed with the keenest regrets was the treatment of Dr. Faraday with a feeling of levity. With all due respect to the practical doings of platers and to any practical men, I must say that it is assuming a very great deal to treat any very fundamental point upon which the electrical and electro-chemical science depends with levity. I feel that part of it comes about from a lack of understanding of the statement of Faraday's Law. First the law states that the total substance deposited is directly proportionate to the current. One mistake has been made in assuming that when the electro-deposit of the metals is carried, the substance is the metal only. The total substance is always directly proportional to the current, but there may be other substances in addition to the metal deposited. These may be tremendous in volume though not much in weight. Another point I call to your attention. It is very likely that electroplaters do not have the opportunity of using strictly accurate instruments and do not realize that fact. It is one thing to use an instrument marked in volts or amperes, and it is another thing to know whether these markings are correct. While commercial instruments are claimed accurate to within 1 to 2 per cent, we have noticed in precision work in the laboratory that very frequently the error is sometimes 20 to 25 per cent, plus or minus.

That the deposit is strictly proportionate to the current is proved in a practical way by making exact measurements with precision current measuring devices.

All ampere-meters are calibrated in terms of electrodeposits. An ampere does a certain work under certain conditions, and therefore, if, when we operate under definite conditions, and get certain results and the amperemeter does not check, it is wrong. It must be so. This has been established by thousands of experiments. In our work in heavy nickel deposits we have made upwards of 1000. Each has been accurately weighed, most of them with laboratory meters and the most precise ones with a precision meter. But we have come to doubt even these. We are now getting accurate current control with the potentiometer current measurement method.

One is assuming a great deal to check work which was done with precision instruments, with commercial instruments 25 per cent off. Do not make the mistake of using second or third or fourth grade instruments for such measuring. An accurate instrument costs about $1,000. If you think you can buy an instrument for $10 you will stop and think twice. It cannot be done.

Faraday's law is absolute by the definition that an ampere is that amount of current by which a certain amount of metal is deposited, under certain conditions. It is really pathetic to presume to question anything of that kind, especially when it is a matter of definition.

On the matter of ampere hours per square foot, I feel that the work of Mr. Hogaboom is very important and very interesting. I agree with Mr. Hogaboom that we do not know the factors which govern throwing power. We thought it conductivity but, of course, we changed our mind. What it is, I cannot say. The only comment I would make is that work of that kind is not of much scientific value as it would be if the complete analysis of the anode were taken. I have always felt that the factor of deposition was governed more by the anodes than by the solution itself.

I don't believe it is possible to maintain a solution at strength without any less proportion of anode to cathode surface than 1 to 1. In many types of commercial solutions it took over 5 to 1. The best we could get as a rule was 1.5 to 1. We got down as low as ¾ to 1, but it was rather an unusual thing. Our work was all based upon making deposits 1/32 to ⅛ inch thick. I feel that in work that is done on those small ratios, one keeps taking a large part of the metal out of the solution, and supplying the metal with salts, rather than supplying the metal from the anodes. Of course, this is very expensive.

MR. HOGABOOM. On the statement about what anodes were used. In the first four pieces I used 98.6 per cent rolled anodes. With the latter I spoke about the cast anode. Our experiments were essentially commercial and not scientifically accurate.

DR. MADSEN. In Canada using a very large nickel cathode, we made about four tons of ductile sheet nickel from 5/1000 to ⅛ inch thick. We made about four tons of it plated 2 x 2. We first tried to do it in a still bath without any mask. It came out with a hump just below the solution line and at the bottom. We adopted a system of circulation, in a bath 25′x 3′x 5′. Circulation cut the humps down mostly at the top. However, we still got the same thing at the bottom. We adopted a system of celluloid masks. With celluloid masks on we still got two humps.

Now the sheet nickel is made on big drums. We finally adopted a tank two feet by twenty. I thought it interesting for you to know that the work on a large scale showed the same distribution of metal as a piece 13 inches high.

In view of the fact that the above discussion is necessarily sketchy, due to the exigencies of stenographic reporting, we will publish, in our next issue, a revised and complete article giving Dr. Madsen's views.—Ed.

Copper and Brass Welding*

Rods used for filling welds in copper are made of copper to which has been added a small amount of phosphorus as a deoxidizer. Very encouraging results are being obtained in the tensile strength of the welded metal. Until recently only about 14,000 lb. per sq. in. tensile strength was obtained in copper welds, but improvements in rods have made possible the production of welds testing over 22,000 lb. per sq. in.

Brass is successfully welded, rods of the usual brass compositions being satisfactory for this use. There is some loss of the zinc content—about 2 or 3 per cent escaping as fumes. A suitable flux is always used in welding on brass or bronze. The flux forms a thin slag, coating over the weld and preventing oxidation and at the same time dissolving impurities and floating them to the surface of the weld. The most popular welding rods are the manganese and Tobin bronzes.

*From Welding Rods for Oxy-Acetylene Welding, by J. R. Dawson of the Union Carbide and Research Laboratories, Long Island City, N. Y. Read before the annual convention of the Interatioal Acetylee Association.

The Peeling of Nickel Deposits

Part 2—The Influence of Iron in the Electrolyte, and Methods for Its Removal. The Condition of the Surface to Be Nickeled*

By E. A. VUILLEUMIER, Dickinson College, Carlisle, Pa.

The time is not yet ripe for a final discussion of the mechanism of peeling. It would seem at present, however, that the following factors are definitely involved:

(1) When the current is passed through a nickel electrolyte the metal is deposited in a form which tends spontaneously to contract and to peel.

(2) The degree of contraction is influenced by the structure of the deposit, which in its turn is influenced by the nature of the electrolyte, the conditions of electrolysis, and through these indirectly, in part, by the hydrogen and iron content of the deposit.

(3) Whether or not the deposit actually peels depends finally upon the degree of its adhesion to the surface plated.

The fact that nickel as deposited tends spontaneously to contract is indicated by the experiments with the contractometer (METAL INDUSTRY, Oct., 1921, p. 419). It manifests itself also in the tendency of the nickel to "crack and curl off in rolls, like wood shavings."

Exfoliation is sometimes attributed to the hydrogen that is known to alloy itself with the nickel deposited. The amount of hydrogen alloyed has been found to decrease in the successive "layers" as the electrolysis progresses, causing internal stresses. This difficulty is partly eliminated by working with a hot bath; the hydrogen content of the deposited metal then becomes more nearly uniform, and the nickel is less apt to curl.

There is accumulating, however, some evidence tending to show that any abnormal tendency to peel is due primarily to the presence of iron in the anode, and therefore also in the electrolyte. Foerster and others have made some interesting investigations in this direction (see Foerster-Electrochemie Waesseriger Losungen—2nd edition). They have found that it is possible under ordinary conditions to obtain from a pure nickel bath a deposit of considerable thickness before exfoliation sets in. If, however, the same bath contains even a small quantity of iron, spontaneous peeling is noticed before one-tenth the previous thickness of metal has been deposited. This is in accord with Watts' older observation (Electroplating and Electro Refining—2nd edition revised), made unquestionably upon the basis of nickel baths containing iron, that if an attempt is made to deposit more than a limited amount of nickel, the deposited metal will always separate from the underlying metal.

From the relative positions of nickel and iron in the electro-motive series it would seem that the passage of the electric current through a solution containing both metals would afford a deposit containing no iron. Actually it has been found that the deposit is even richer in iron than the solution itself. Matters are further complicated by the fact that as the electrolysis proceeds, care being taken that the iron content of the solution remains constant, the amount of iron decreases gradually, remaining, however, higher than the iron content of the bath, and only after a considerable time becomes constant.

Thus a solution containing one gram equivalent of nickel sulphate, iron to the extent of two percent of the weight of the nickel, and sulphuric acid 0.03 normal was electrolysed at 20 c with a current density of 0.0125 amp/square cm. The first 0.04 grams of metal deposited upon 100 square centimeters contained 24.6% iron, while the layer deposited during the time that from 0.4 g to 0.7 g were deposited contained 12.2% iron. Foerster claims that, since the iron content influences the mechanical properties of the deposit to a marked extent, there result mechanical strains which tend to favor exfoliation. If the bath is hot, the composition of the nickel iron alloy approaches the ratio of the nickel to the iron in the solution, the composition of the alloy is almost constant, and there is less tendency to peel. Foerster states that the causes for this peculiar behavior have not been ascertained. The claims of British Patent 159,906, March 27, 1918, do indicate an explanation. Estelle was able to obtain from a slimy suspension of ferric hydroxide in sodium hydroxide a smooth iron deposit. If nickel hydroxide is also present there is no nickel deposited. At some future date it may be possible to discuss the merchanism of deposition; for the present it may be indicated that there is evidence that hydrolysis is possibly an intermediate step having a considerable influence on the nature of the deposit.

Experiments with the contractometer are fully in harmony with the foregoing observations. If the nickel bath contains iron there is a much more marked deflection of the pointer than when the nickel electrolyte is pure.

These results seem to indicate quite conclusively that iron in the electrolyte is largely responsible for any abnormal tendency toward exfoliation. Foerster goes so far as to state that iron is the "cause" of peeling.

In any event the desirability of working with a nickel bath free from iron would seem to be indicated.

Nickel anodes appear to contain from 1 to 10 percent iron. The periodic removal of iron from nickel baths, however, is a comparatively simple matter.

The writer was confronted with the problem of preparing a nickel solution absolutely free from iron. He had at his disposal 1 kilogram of nickel castings containing several percent iron. These he dissolved in hydrochloric acid, filtered, and added chlorine water. The solution was evaporated to dryness twice to expel the excess chlorine, and the residue, consisting of nickel chloride and ferric chloride was dissolved in water. Sufficient freshly precipitated nickel carbonate was added to leave the solution distinctly turbid. The solution was then filtered. It was impossible to detect iron in the filtrate even by means of the delicate sulphocyanide reaction. Plastic nickel carbonate therefore completely precipitates ferric iron. No foreign substances are introduced into the solution, since the iron in the solution is replaced exclusively by nickel.

Ferrous salts are not completely removed unless the solution is agitated for some time in the presence of the nickel carbonate, or unless the iron is oxidized. This latter may be conveniently and cheaply done in the case of the sulphate bath by means of barium dioxide. The barium dioxide that is reduced is converted into barium sulphate, which is insoluble.

Double salts here again appears as a likely "enemy of progress." Greater difficulty is experienced in freeing a solution of nickel ammonium sulphate from iron. Nickel carbonate is soluble, ferrous hydroxide is slightly soluble in the ammonium salt. Here again the addition of barium dioxide aids in the precipitation of the iron. Nickel deposited even under favor-

*Part 1 was published in our issue of October, 1921, Page 419.

able conditions is under a strain and has a tendency to contract. Iron increases the tendency to contract. The peeling of nickel deposits is, however, certainly due in part to the presence of traces of grease or tarnish on the surface to be plated. If the deposit adheres firmly to the surface plated, peeling is plainly out of the question. The adhesion of the deposit would in a given case seem to depend upon the condition of the surface to be plated. The next problem would be to measure the degree of adhesion. This would incidentally furnish a method of testing the efficiency of various methods of cleansing objects to be plated. An attempt is being made to develop a method for making this measurement. The plan is to fasten a small plug of definite diameter to the plated object. The plated object is supported on a convenient stand, and weights are added to a pan attached to the plug. The degree of adhesion is measured by the weight necessary to pull the plating away from the surface plated. Practical difficulties in the direction of a suitable cement have been encountered. For extremely poor plating a wooden plug and glue have proved fairly satisfactory. The writer would be thankful for suggestions as to a suitable cement.

Plating Problems

Difficulties Which Arise and Their Solutions

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

GOLD PLATING

Q.—I have read with interest in THE METAL INDUSTRY the proper way of plating die-cast phonograph parts. I would be interested to know just how you would polish or finish to get gold satin finish and the regular gold brush finish. Or what is the difference between the two?

I have in mind, however, that the satin finish is brushed with a small tampico brush wheel and pumice after the die casting is cut down and colored up ready for plating.

A.—In gold plating die-castings, the following methods should be followed: The die casting should be cut down with tripoli composition, unless very rough, then it may be necessary to polish them with emery or emery composition.

After cutting down, cleanse the castings carefully with a mild alkaline cleaner. If an excess of buffing dirt remains on the castings, then a wash in benzine should be used to remove the excess. Follow by drying out in maple wood sawdust and then cleanse in the alkaline cleaner. The castings should not darken. After washing thoroughly in cold water, nickel plate them.

It is necessary to have an efficient nickel solution for die castings, one that will plate uniformly without burning or black streaks.

After nickel plating and washing in water the nickel plated parts should be brass plated for a few minutes, then washed and scratch-brushed with very soft brass wire brushes.

Some firms just use the scratch-brush, other firms use a little pumice stone, when brushing to give more of a brush gold effect. Both methods result in the so-termed satin finish, but in reality they are brush-finished.

After brass plating and brushing the castings are cleansed lightly and gold plated and finally dried and lacquered.

If the gold solution plates bright, then no further operations may be necessary, but if the gold deposit is dull, then the gold plated castings will have to be very lightly re-scratched-brushed or rubbed down with bicarbonate of soda. Many firms use the latter method.

In producing the satin gold, use the sand-blast or the wire satin finishing brush. Either method gives a satin or matte finish. With the sand-blast a very fine sand with a low pressure must be used. The operations following the satin finishing are as outlined: cleansing, nickel plating, brass plating, brushing, gold plating, and lacquering.

The buffing of nickel-plated die castings to be gold plated should be avoided or trouble will result, unless unusual care is used in recleansing before brass plating.

It is only necessary to nickel plate the die castings for a few minutes in a properly prepared nickel solution.

NICKEL CONDUCTIVITY

1. My single nickel salt solution contains sal ammoniac 2 ounces per gallon, hydrofluoric acid 1/8 ounce per gallon, and about 10 ounces per gallon of single nickel salts. This solution when new will stand about 7 degrees Baumé on the hydrometer and when I plate I get 2 volts and 50 amperes by advancing my rheostat on two points. Now what I want to bring out is if I would increase the metal content by using single nickel salts so my Baumé reading would read 12, would I get more voltage and amperes through my solution by using 2 points on my rheostat as before? In other words is a dense nickel solution a better conductor than one that is low in metal, as nickel itself is a good conductor of electricity. My knowledge of plating has always been that a more dense solution will require a higher voltage to go through. Or in other words a solution standing 7 degrees Baumé will give good results at 2 volts if in proper condition, while one that stands 12 degrees Baumé will require 3 volts to get the same amount of amperes through the solution.

1. The metal content of any type of an electroplating solution is an important factor. Solutions low in metal do not deposit metal as fast as solutions that contain not less than four ounces of metal per gallon. Again there is no advantage in using them too high in metal.

Amperage tells the story of the rapidity of the deposit, not the voltage, which is only the pressure back of the amperes that constantly pushes them along. In other words, voltage overcomes the resistance.

You speak of using 50 amperes at 2 volts in a nickel solution containing 10 ounces of single salts, 2 ounces of sal ammoniac, 1/8 ounce of hydrofluoric acid. Nothing can be determined by this statement unless the surface area of the articles plated in such a solution is known. Only when you have this figure, can you determine the efficiency of deposition as compared with solutions of higher metal concentration, such as a nickel solution suggested by the Bureau of Standards, Washington, D. C., which is very high in metal.

Water	1	gallon
Single nickel salts	37	ounces
Sodium fluoride	1¼	ounces
Boracic acid	4	ounces

Temperature 120 to 160 degrees Fahr. Over 40 amperes can be safely carried upon a square foot of surface at 5 volts with such a solution.

Now presuming that at 2 volts you use 40 amperes and have 8 square feet of surface, as articles to be plated, then you are only using 5 amperes per square foot. In other words if you could use 40 amperes, the deposit could be obtained in one-eighth the time that you require at present.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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EDITORIAL

THE MEETING OF THE INSTITUTE OF METALS

It is not too much to say that the meeting of the Institute of Metals, just held, was one of the most successful in its history. With an attendance so large that it was found necessary to obtain larger rooms than had been at first provided, with a number of thorough and original papers, and with spirited discussions, the two days session will remain in the memory of those who were fortunate enough to be able to attend. The program was carefully and wisely arranged; it covered the field of metals from both the theoretical and the practical sides.

Several papers stood out from the rest, not necessarily because they were better pieces of work, but because they were distinctly novel. A paper on spectrum analysis by Bassett and Davis aroused a great deal of interest in the possibilities of this kind of work. It seems that the spectroscope is a much more delicate instrument for analytical purposes than the ordinary chemical and physical apparatus, that it is possible to discover materials in such small quantities that they would ordinarily evade the chemist and metallographer. Moreover, it was stated that a real future lay before the spectroscope as an instrument for quantitative analysis of small amounts of materials.

A paper on Crystal Structure of Solid Solutions, Studied by X-Rays, by Bain, was also of great interest, as it showed the increasing use and the possibilities for investigation into the constitution of metals by means of the X-Ray.

A very thorough resume of the results achieved by the Corrosion Committee of the British Institute of Metals, by Thum, and two very practical and well worked-out papers on Experiments with Sherardizing, by McCulloch, and Arsenical Bearing Metals, by Roast, elicited considerable discussion. The innovation of a lecture, which, this year, was delivered by Prof. Bancroft of Cornell University, on Colloid Chemistry and Metallurgy, was a happy one.

Meetings of this sort show plainly the reasons for the growth of the Institute up to almost one thousand members. The Papers Committee and the officers who managed the meeting are to be congratulated.

SCIENCE VS. GUESSWORK

In a very interesting talk by George B. Hogaboom of Waterbury, Conn., on Amperes per Square Foot, which was delivered before the New York Branch American Electroplaters Society (published elsewhere in this issue), he pointed out among other things the necessity for extreme care and accuracy before drawing general conclusions. In comparing the work of Lovering who had challenged Faraday's Law, claiming that he had achieved results in the deposition of nickel which exceeded those stated by that law, Hogaboom showed that Lovering's errors were due to inaccurate measurement of rough surfaces and rough edges, and also to the fact that he based his conclusions on measurements taken over a limited area, which did not correctly represent the entire surface of the work.

Although it seems a pity that work must be done to refute the erroneous conclusions gained from inaccurate work, nevertheless, this is, and always has been one of the problems of the investigator. Thanks are due to Hogaboom for showing even such an obvious thing as that Faraday's Law is right. No one knows how many badly-informed platers might have been convinced that Lovering had completely overthrown Faraday.

C. P. Madsen made an excellent point in discussing Hogaboom's paper, when he stated that no one could hope to check scientific data without using scientifically accurate instruments; that the possibilities of error were too great for any one to dare to base conclusions on work done with commercial instruments and particularly those of the poorer grade.

This case should be a lesson to all those who are skeptical of "theory" and "science." It is probable that the average plater is a little too sure of his own results and a little too skeptical of those of the chemist. We believe that he could learn much from what happened to Lovering.

DIRIGIBLE DISASTERS

Another dirigible, the Roma, has come to grief, with the same terrible consequences of loss of life. This catastrophe coming peculiarly enough at about the same time as the report of the British investigation on the fall of the R-38, was made public, offers additional testimony to the conclusion drawn by the investigating committee. It seems that the fault lies in the design. There is insufficient data on the design of such a large vessels as these dirigibles have grown to be, and a great deal of the work is still experimental. It is fearful to contemplate the loss of life entailed by these experiments, and it is made none the easier when we realize that we are only duplicating the work which Germany has already done with her Zeppelins. It is now freely admitted by Germany that a great many Zeppelins were lost during their period of experimentation.

The whole subject of dirigibles is of tremendous importance to the aluminum industry because of the fact that the structural material used in them is largely Duralumin, an alloy of aluminum. (Description of the structure have been published from time to time in THE METAL INDUSTRY.) If any insuperable difficulties were discovered in the way of using dirigibles as a standard form of aircraft, it would be a severe blow to the development of Duralumin.

According to the report by the Aeronautical Research Committee of the British Air Ministry, some of the causes of the failure of the R-38 (renamed in the United States ZR-2) were as follows:

> That the accident was due to structural weakness in the design of the airship.
>
> That the provision of specially powerful control surfaces of new design virtually accentuated this weakness.
>
> That no calculations were made of the stresses due to the aerodynamic forces to which the ship would be subjected.
>
> That in consequence, the calculations made by the design staff, taking specific account only of the forces and movements due to the distribution of weight and buoyancy, including gas pressures, were misleading.

That for the progressive development of airships in size and speed reference to first principles in design is necessary, and that it is not sufficient to place exclusive reliance on comparison with existing ships.

That the existing methods of calculation at present in use for determining the scantlings of structural members of an airship are insufficiently accurate for this purpose and that more exact methods, the outline of which can at present be indicated, should be developed.

That the terms of the requirements laid down in time of war for R-38 were extremely drastic and that the limitations involved by the size of the shed in which the airship had to be built imposed too severe a task on the designers.

That in spite of the presence of a certain amount of softened Duralumin in the airship, faulty material did not contribute to the accident.

That on the assumption made, the structure was designed with great skill and the necessary calculations were carefully carried out by methods admitted as sufficiently accurate in other branches of engineering practice.

It seems that there is no thought of discarding Duralumin as a structural material. The presence of the few softened pieces mentioned, can be prevented by more careful inspection.

UNEMPLOYMENT

In a very interesting speech by Mr. E. E. Hunt, Secretary of the President's Conference on Unemployment, before a meeting of the New York Editorial Conference, he outlined the work done by that committee, and what he hoped to do in the future. Aside from the measures of immediate necessity, such as providing emergency work to tide over the present period, the Conference attacked the fundamentals of unemployment, particularly with reference to the causes of unemployment. It was decided that unemploymentwas caused by depressions which in turn were caused by the business cycle. The point then was to control the business cycle in order to flatten out the waves. The most important suggestions along these lines seem to be:—

1. That the Government arrange its construction of public works so that they would be pressed forward in times of depression and held back during industrial activity.

2. That the railroads, who were such powerful purchasers, consuming 27% of the country's coal and 20% of the steel and iron, should also hold back their purchases and their new construction so far as possible during times of great activity, and press them forward in hard times.

These two agencies should together prove a strong balance wheel.

A bill by Senator Kenyon, covering the work of the Government mentioned above failed to pass in the Senate. However, the members of the Conference are continuing to get information and statistics so that more work can be done and perhaps more accurate and certain remedies for the difficulties occasioned by the business cycle can be evolved.

THE DAILY ROUND

Every day as we sit down at our desk, we are met by circulars, pamphlets, propaganda and literature sent out by institutions for purposes of all conceivable sorts. When one considers the mass of printed material drifting hither and thither in the mails, one is tempted to be a little less critical of the Post Office. Millions of letters, millions of people writing, talking and perhaps even thinking about the same topic, namely how to "improve conditions". If one were to ask them what they mean by conditions, however, one would get a set of widely varying answers. Some mean business, some mean labor, some mean the starving children of Europe and a great many mean their own personal circumstances. If one were to ask how to remedy these "conditions" one would get even greater divergence. Everyone has a scheme, every institution has a plan. All these schemes and plans are sent out neatly multigraphed with permission to print either with or without credit, and as we sit and wonder why they send out this material, why they write so much and talk so much, we find on reading it through, that underneath it all is a bright, shiny little axe which is being ground.

They all have someone to blame. At a recent meeting of the four engineering societies inNew York, a Mr. Cabot of Boston, gave it as his earnest, honest and well-considered opinion that engineers were to blame for the difficulties of the railroads and traction companies. Why? Because engineers were poor executives; engineers were a race of asectics, whose habitat was a cloistered cell surrounded by blueprints, tables and a slide rule. Later in the evening it was steadily and in some cases courteously pointed out to Mr. Cabot that the present generation of railway executives were reaping the whirlwind which had grown from the wind, sowed by the earlier generation of promoters and expanders. We doubt, however, if Mr. Cabot was convinced. He had his story and he stuck to it.

For a long time everybody blamed the steel makers for holding up their prices. Now steel prices are down to within 25 per cent of the pre-war level. The banks have been a favorite target for a long time. Business men pointed with rage to the fact that while they were going profitless, passing dividends and turning gray attempting to borrow money, the banks were declaring usual dividends and handing out bonuses. Manufacturers, bankers, steel men and even, we imagine, Mr. Cabot, have been unanimous in hammering labor and demanding that wages come down to make it possible to carry on business as before. Labor has been equally unanimous, wherever strong enough to manage it, in declining this offer, but has taken considerable cuts in a large number of industries. In the meantime the farmers who were the first to suffer, who have had probably a worse time than any other group in the country and who have had the sympathy of all other classes, decided that sympathy is a poor substitute for comfort and took matters into their own hands. As soon as this happened, however, the agricultural "bloc" was made the target for abuse and reproach from almost every other organization in existence. Isn't it strange?

We still have with us the gentlemen known as "Gawd-sakers" whose cry is "For God's sake let's do something anything. Let's go to work, let's start something, let's buy something, let's sell something," but when asked for details they are helpless. We also have with us the gentlemen of the golden rule who says "Don't fight boys, settle it peaceably. Your interests are identical." When asked to show identity of interests between two men, both of whom are trying to get the major share of something very limited in size, he is very unconvincing.

What is the answer? Is there any answer? Probably not. After sufficient time has elapsed things will gradually fall into line. They will not straighten themselves, nor will they become absolutely straight. No one man or group of men will be responsible for the improvement which will come although any number will attempt to gain credit for it. Hard work, forced upon most of us by the desire to remain alive, will be the most important factor.

CORRESPONDENCE AND DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein.

ELECTRIC VS. CRUCIBLE FURNACES

To the Editor of THE METAL INDUSTRY:

Concerning the letter on "The Electric Brass Melting Situation" from Mr. Thomas H. A. Eastick, of Montreal, Canada, in your February issue, would say that I have now and then noted in the METAL INDUSTRY comments from the same author, bearing very similar notions. I have also noted comments, arguments, facts and test data offered in support of the electric brass melting furnace by competent authors, among which I believe, was Dr. Gillette.

Although Mr. Eastick's opinion has not been changed by all these facts and arguments, it would seem that if he is as familiar, as you and I, with the rapid adoption of the brass melting furnace in many brass foundries and rolling mills, he would agree that this in itself is conclusive proof that it affords advantages over the fuel fired furnace. There was a time, perhaps, when there appeared need for discussion and argument of this matter. However, it would seem that the high-grade performance of the electric brass melting furnace makes for itself a defence that is impregnable.

E. F. COLLINS,
GENERAL ELECTRIC COMPANY.

Schenectady, N. Y., February 18, 1922.

GREASE FOR GROUND PLUGS

To the Editor of THE METAL INDUSTRY:

In a recent issue of THE METAL INDUSTRY I saw a receipt for making a cock-grease which you highly recommended. As I had about 30 ground key cocks on my lathe in the workshop and my employer provides a very indifferent cock-grease for all his work, I eagerly set about making the grease you recommended. The cocks are used for mixing hot and cold water in hospitals and institutions and have to be perfection itself. Of course, the old grease does not stand long or work well when the cock is constantly heated by the hot water and I looked on your receipt as a great help. But alas! I wouldn't put it on the cheapest key made—it is worse than useless. You said it had "body"—it has none. I certainly hope that the other recommendation I read in each issue on metals, etc., supposed to be of great value to manufacturers are a little better than your recommendation of such a cheap and common thing as cock-grease, otherwise you may as well devote all the paper to advertisement.

The grease formula that appeared in a recent issue of THE METAL INDUSTRY is used by the largest brass manufacturing concern in the United States for use on water cocks standing a hydraulic pressure of 200 lbs.; also gas cocks standing hydraulic pressure of 100 lbs. when tested. This formula allows the key or plug to turn in the body smoothly and freely, and does not dry out.

If you want more body to your grease add more bees wax and reduce the fat contents of the formula. This grease, when thoroughly mixed and put away to set should always be hard in hot weather, so the more body you desire comes from the addition of the bees-wax.

I presume when your inquirer mixed all the ingredients that were mentioned in the formula and went to use it next day he found it very hard and could not apply it to the plug, and therefore condemned it. To apply this grease on the plug it should be melted and put on in a liquid form with ½" varnish brush. It will spread well and set with a film on the plug. If the ground key cocks are to be used on hot water or steam use graphite mixed with this formula. It will still give it body and the heat will not affect its action as lubricant.

To test the grease for body and lubricating qualities place small amount between the thumb and finger and see that it has adhesive qualities.

Please furnish me a sample of the grease you made up from the formula that you condemn, as I know there is something wrong and that you have not followed the instructions in preparation of same.—P. W. B.

NEW BOOKS

The Ever-Ready Pipe and Elbow Chart by M. W. Pehl, published by U. P. C. Book Company, New York. Size 4¼ x 6¼, 62 pages. Price $1.50, payable in advance. For sale by THE METAL INDUSTRY.

By the proper manipulation of the circular chart, included with this volume, one can instantly find the girth, with correct allowance for thickness of material and laps, of any size round pipe. One can also immediately learn the area of a given size of round pipe; or in trunk lines of pipe, in the combination of main and branch pipes, to find the area of the main, and hence its diameter, equally the combined area of the branches, etc. In the instruction book which accompanies the chart, detailed information is presented by diagram and text.

Recovering Precious Metals from Waste Liquid Residues, by Geo. E. Gee, published by E. & F. N. Spon, Ltd., London. Size 5½ x 8½, 380 pages. Price $4.80 payable in advance. For sale by THE METAL INDUSTRY.

Here is a work for which one can only hope that there is a wide call. A book so simply written, so eminently useful and worth while, and which fills a void of such long standing deserves a wide circulation. The author is a practical worker in precious metals of long experience and also the author of a number of hand-books on these subjects. This book is called "a complete workshop treatise containing practical working directions for the recovery of gold, silver and platinum from every description of waste liquids in the jewelry, photographic, process workers' and electroplating trades."

The electroplating trades do not need to be reminded how often it is necessary for them to recover precious metals from solutions which are no longer useful. A work of this sort is just exactly what they need, inasmuch as text books barely touch this subject or treat it only from a hypothetical standpoint.

Among chapters of particular interest are the following:

Recovering Gold from Color Wastes.
Recovering Gold from Electro-gilding Waste.
Recovering Gold from Rinsing Waters and Wash Waters.
Recovering Gold from Dip Gilding Waste and from Old Stripping Solutions.
Recovering Silver from Dip Silvering Solutions and from Sundry Salts of Silver.
Recovering Platinum from Platinum Solutions.
Separating Platinum from Gold.

Estimating Sheet Metal Work, by Neubecker and Hopp, published by U. P. C. Book Co., New York. Size 4½ x 7, 428 pages. Price $3.00, payable in advance. For sale by THE METAL INDUSTRY.

This book tells in plain English how to figure the proper sizes of articles, how to take off the material required from the plans of any sheet metal job, how to buy material and cut it to advantage for different work, how to figure the actual overhead expense for any department, or kind of work handled, in your own shop, and explains the special risks to be considered in making bids, financing, etc. It covers sheet metal work of every kind for piping and ducts, chimneys and ventilators, architectural work and other building work of all sorts. It goes into the details of working costs for different types of sheet metal jobs, and also has a chapter on trade customs, standard price-lists, etc.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical / WILLIAM J. REARDON, Foundry — PETER W. BLAIR, Mechanical / LOUIS J. KROM, Rolling Mill — CHARLES H. PROCTOR, Plating-Chemical / R. E. SEARCH, Exchange-Research.

BOWER-BARFF FINISH

Q.—How is the Bower-Barff finish obtained?

A.—Bower-Barff finish, named after the originators of the excellent rust proof black finish, is obtained as follows:

The iron or steel articles should be clean and given a light sand-blasting. They are then placed in a closed retort or furnace, where they can be heated to cherry red, about 1,250 Fahr. When the articles have reached this temperature super-heated steam is injected into the retort, which develops a black magnetic oxide of iron upon the iron or steel. It takes several hours to produce a good coating. When cool, the surface is wiped dwn with a thin coat of linseed oil and then heated at 212 deg. Fahr., until the oil becomes dry.

The black finished hardware seen in modern hotels has the Bower-Barff finish.

Improvements in the method patented a number of years ago, (which have probably expired) consist of injecting with the steam a small proportion of a hydro-carbon, such as benzine or gasoline, as a spray. It is claimed the oxide of iron is produced more quickly, when the hydrocarbons are used.—C. H. P. Problem 3,046.

CLEANERS

Q.—What is the best metal cleaner?

A.—There are so many good cleansers on the market for preparing metal surfaces for plating that we hesitate to give you the name of any one firm. See the advertising columns of THE METAL INDUSTRY.

Try the following composition:

Water	1 gallon	
Caustic Soda	3 ounces	Temp. 180 to 200 deg.
Soda Ash	2 "	Fahr.
Tri-Sodium Phosphate	2 "	
Corn Syrup or Karo.	¼ "	
Sodium Cyanide	¼ "	

Prepare the cleaner in the order given. If the cleaner so prepared is too strong for your purpose reduce the proportions 25%. If not strong enough, increase the proportions 25%.—C. H. P. Problem 3,047.

COLORING SOLDER

Q.—How can I give solder a brass color?

A.—The reduction of two metals by the steel or iron contact method is more difficult than when one metal such as copper is precipitated upon solder metal. However, it is possible to do this. Dissolve 1 ounce of tin chloride crystals in as little hot water as possible for solution. Then take a portion of your copperizing solution and add small portions of the tin chloride solution to it and make tests upon your solder. The color will not be a true brass color, but incline to a bronze shade which will no doubt answer your purpose. A little experimenting on your part will enable you to get the desired results.—C. H. P. Problem 3,048.

CUPRO NICKEL

Q.—What is a good formula for cupro nickel?

A.—Cupro nickel, or nickel silver, probably exists under a greater number of names than any other alloy. Copper nickel alloys are rarely used except in cases of coinage. The American Government adopted an alloy for 2½ per cent. nickel for driving bands of projectiles, called "cupror nickel." An alloy containing 60 per cent. copper, 40 per cent. nickel is known under the name of constantan and is used in the form of wire for electric resistance, and also in conjunction with copper wire as a thermo-electric junction suitable for the measurement of temperatures, which are not sufficiently high to necessitate the use of a platinum couple. Nickel silver is by far the most used alloy, and under the name of nickel silver are included a large number of alloys containing copper, nickel, and zinc, and sometimes other metals. The alloy generally is in two classes; the one is used only for sand casting (No. 1), and requires to be cast well and run free from dross; the other alloy (No 2) is used for stamping and spinning, and must be ductile so as to draw in shapes.

No. 1.		No. 2.	
Copper	59%	Copper	50%
Nickel	20%	Nickel	20%
Zinc	20%	Zinc	30%
Aluminum	1%	(Flux—2 ozs. Magnesium)	

There are possibly one hundred alloys in different proportions of this same mixture, but all are like this mixture. This alloy is white and will give all the results required from German silver.—W. J. R. Problem 3,049.

FLUX FOR TINNING

Q.—We should like to receive information on metal cleaners and fluxes for hot retinning of dairy ware.

A.—Any of the cleaners advertised in THE METAL INDUSTRY will prove satisfactory for your purpose. All that is necessary is to have a clean surface free from oxidation. Such a cleaner should be used on the basis of 8 to 12 ounces per gallon of water at 200 degrees Fahr. For removing rust or scale use a mixture of equal parts of muriatic acid and water at a temperature of 140 to 150 degrees Fahr.

As a tin flux use a solution prepared from zinc chloride and sal ammoniac as follows:

Add sheet zinc in small quantities at intervals to commercial muriatic acid until the acid on becoming cold will not dissolve any more zinc. Allow the mixture to settle and filter through several thicknesses of cheese cloth to remove any lead particles, which may be undissolved as impurities in the zinc. To every gallon of zinc chloride so prepared, add 2 pounds of white sal ammoniac. Some tinners add all that the zinc chloride will take up, about 3 to 4 pounds, but 2 pounds is usually satisfactory.

Use tallow, palm or cocoanut oil on the top of the tine of your finishing kettles.

Two ounces of carbonate of ammonia added to every gallon of quenching water gives a brighter tin deposit, unless kerosene oil is used.—C. H. P. Problem 3,050.

RUSTY SURFACE

Q.—How can I produce a rusty surface on iron?

A.—To produce a rusty iron surface upon iron immerse the articles in a strong solution of sal ammoniac, then drain them well and hang them up to dry. The iron surface will soon be covered with rust.

You can try from one to two pounds of sal ammoniac per gallon of hot water.

You cannot produce a rust by electro-plating methods.—C. H. P. Problem 3,051.

WHITE METAL PATTERNS

Q.—I want to make a white metal pattern, approximately 3 feet 6 inches in diameter. My trouble is shrinkage and cracking at the hub.

A.—I would say that the best white metal mixture to use for white metal patterns is composed of 55 per cent. tin, and 45 per cent. zinc. Eliminate the shrinkage as much as possible by adding ½ per cent. bismuth. However, this is not essential. When pouring the white metal, pour the castings as cold as possible. This heat may be determined by placing a pine stick in the metal, so that the stick will not burn. It is then at the right heat to pour.—W. J. R. Problem 3,052.

LEAD ON ZINC

Q.—What is a good solution for plating lead on zinc?

A.—To lead plate successfully upon zinc it is advisable to use two solutions, a striking solution and a plating solution.

Water	1 gallon
Rochelle Salts	6 ounces
Lead Cyanide	2 "
Caustic Potash	1 "

Temperature 160 to 180 deg. Fahr. Lead anodes; voltage 1½ to 2.

After striking the zinc parts in the above solution, then plate in a lead fluorsilicate solution prepared as follows:

Water	1 gallon
Lead Fluorsilicate	10 to 14 ounces
Free Fluosilic Acid	2 to 12 "
Transparent White Glue	¼ to ½ ounce

Voltage 2 to 4. Agitate the solution during plating operations. The solution should be used at about 80 deg. Fahr. with lead anodes.

Instead of preparing the laid fluorsilicate solution you can purchase it from lead refineries. The solution is a by-product in the refining of lead, and can, therefore, be purchased quite reasonably.

Use this solution as received without further dilution, if you want a heavy deposit of lead. Otherwise you can reduce with water 25%.—C. H. P. Problem 3,053.

MIXING

Q.—We are melting 67 copper, 29 zinc, 3 lead, 1 tin. The metal is good, but when it goes to the machine shop it is too soft to thread. I mix it by melting the copper first and then adding the zinc, lead and tin, after the copper is hot. In 10 minutes I pour.

A.—This alloy is not difficult to cast. If it is too soft, I would suggest to change the mixture to 75% copper, 20% zinc, 3% lead and 2% tin. This mixture will be found to give excellent results in the machine shop for such work as you describe. However, if you must have your mixture of 67 copper, 29 spelter, 3 lead and 1 tin, cut down your copper to 66½ and add ½% of 30% manganese copper, which will act as a deoxidizer and hardener. Melt the copper first under a cover of charcoal. Add a small amount of salt, after which add the manganese copper. Break the spelter in small pieces, and add a little at a time to the copper. Stir well, and add the lead and the tin. Stir well again, and then pour at about 1900 to 2000 degrees Fahr.—W. J. R. Problem 3,054.

NICKEL ON DIE CASTINGS

Q.—Please give me a nickel solution for die castings?

A.—Die castings should be cleansed in mild alkali cleaners, such as those advertised in THE METAL INDUSTRY, about 6 ounces per gallon of water. After cleansing they should be washed thoroughly in water and immersed momentarily in a cyanide dip.

Water	1 gallon
Sodium Cyanide	4 ounces

Aterwards rewash them in cold water and plate direct. The castings should never turn dark in cleansing. If they do they are liable to cause peeling of the nickel.

A nickel solution for die castings is composed as follows:

Water	1 gallon
Double Nickel Salts	8 ounces
Common Salt	3 "
Sodium Citrate	3 "
Sal Ammoniac	½ "
Epsom Salts	½ "

Temperature 80 degress Fahr. at 4 to 5 volts. As nickel solutions become rapidly acid and when plating die castings, it is always advisable to keep some nickel carbonate or nickel hydrate in the nickel solution to neutralize the free acid. When black streaks develop, more sodium citrate should be added to the nickel solution.

The nickel carbonate or hydrate should be suspended in the solution by the aid of bags made of several thicknesses of cheesecloth.—C. H. P. Problem 3,055.

PEBBLE FINISH

Q.—What is the "Pebble Finish" on castings?

A.—"Pebble Finish" is used mostly on name-plates and is molded with the castings. It is similar to matted finish. However, matted or frosted finish on brass castings is produced by sand-blast. Matted finish on metal or all kinds of glass is done by holding the article under the steam of sand, just as you would a glass of water under a faucet. In a few seconds the work is done.—W. J. R. Problem 3,056

PEELING NICKEL

Q.—I have trouble with my nickel tank. About a year ago I got new nickel anodes and these anodes are very hard. From that time on my nickel solution was getting dark. I didn't make much of it, for my nickel deposits were good. Then later I got a little peeling but I didn't mix any more solution because mine stands about 10. About 3 weeks ago I hung in some more new anodes, (which made all new ones). My solution got still darker. Then the nickel deposits pitted from the bottom and burned and peeled. The solution worked slowly. I added single nickel salts and the deposits came a little better. Later I added conducting salts, nickel chloride, and got the solution a little better color but still my work burns from the bottom and peels. What can I do? Do you think this due to lack of single salts? I mix my solution with single and double salts and boracic acid. Is boracic acid a conductor?

A.—Your nickel anodes were evidently cast in chilled iron mould. This is what causes the surface of the nickel anodes to be so hard.

They should be either heavily sand blasted or dipped for 5 or 10 minutes in strong nitric acid until the hard surface is softened. If you cannot use either of these methods, then grind off the hard surface with emery wheels.

The lack of anode surface has caused your solution to become depleted of metal. The depletion caused the dark deposit. You might add more nickel chloride, say 1 to 2 ounces per gallon, and also add 1 ounce of sal ammoniac per gallon. If the color does not come a good white, then add ⅛ ounce of muriatic acid per gallon of solution.

Boracic acid is a conductor to a certain extent. Its value is more that of a softener for the nickel deposit than that of a conductor. Sal ammoniac is the very best conducting agent you can use.

If the additions we have suggested bring up a good white color, but the deposit peels, then add ½ ounce of sodium fluoride per gallon of solution. The sodium fluoride will drive the hydrogen out of the solution. It is the hydrogen that deposits with the nickel which causes the peeling.—C. H. P. Problem 3,057.

GREEN FINISH ON IRON

Q.—How can I get a green finish on an anchor to give it the appearance of age?

A.—If the anchor is made of iron it should be free from oxide and scale, and thoroughly cleansed. A verde green finish may then be deposited directly upon the iron by using the following formula:

Water	1 gallon
Bichromate of Potash	12 ounces
Copper Sulphate	4 "

Use anodes of copper or carbon. Plate at 2 to 4 volts. As soon as the Verde Green is deposited the articles should be removed, washed and dried carefully and finally lacquered or waxed.

To give the articles the appearance of bronze they could be copper-plated first.

Lacquer enamels applied by spraying are also used extensively for Verde Green finishes upon art metal goods, made of iron, antimonial lead, etc. They can be obtained from any reliable manufacturers of lacquers.—C. H. P. Problem 3,058.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,397,222. November 15, 1921. **Electrolytic Refining of Tin.** Frank C. Mathers, of Bloomington, Ind., assignor to American Smelting and Refining Company.

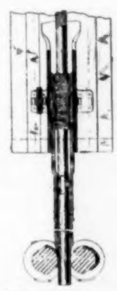
The invention relates in general to an improvement in the process of producing electrolytically refined tin from impure tin cast in the form of anodes and acted upon by an electrolyte and features the situation where there is a relatively low tin content and a relatively high sulfuric acid content.

1,397,514. November 22, 1921. **Process for Depositing a Metallic Coating on Various Metal Articles or Objects.** Frederick W. Haines, of Township of Sandwich East, Ontario, Canada, and Frank L. Sorensen, of Detroit, Mich., assignors by direct and mesne assignments to the Metal Protection Laboratory, of Detroit, Mich.

This invention relates to the coating of metal articles or objects with metal and is applicable to the deposition of thin films of numerous metals upon numerous other metallic bodies, as is frequently desirable for decorative purposes and for the prevention of oxidation, corrosion or rusting.

1,400,156. December 13, 1921. **Electrically-Heated Soldering-Iron.** James T. Griffin, of Oak Park, and William A. Timm, of Berwyn, Illinois, assignors to Western Electric Company, Inc., of New York, N. Y.

This invention relates to electrically heated soldering irons, and its object is to produce a soldering iron in which the heat of the heating unit will be directed to the soldering tip without waste by radiation, thereby enabling the heating unit to be worked at a much lower temperature than has heretofore been possible, whereby the cost of operating the iron will be reduced to a minimum, and the deterioration of the heating element from burning out will also be reduced.



1,399,401. December 6, 1921. **Tube-Rolling Mill.** Jacques Reimann, of Erdington, Birmingham, England.

It is the principal object of the present invention to provide means for operating the sleeve positively in either direction of endwise movement without interfering with the normal action of the machine. A further object is to provide a simple means of attaching the mandrels to the mandrel carrier and locking them by means of the aforesaid sleeve.

1,400,527. December 20, 1921. **Alloy.** Alvah W. Clement, of East Cleveland, Ohio, assignor to the Cleveland Brass Manufacturing Company, of Cleveland, Ohio.

This invention has for its object, the provision of a metal alloy which is highly resistant to oxidization and warping, and generally effectively withstands deterioration when subjected to repeated heatings to high temperature. Furthermore, the alloy is easily machined and may readily be cast.

1,401,215. December 27, 1922. **Mold for Metal-Founders' Use and Composition of Matter for Making Same.** Harold G. Weidenthal, of Cleveland, Ohio; Louise S. Weidenthal, executrix of said Harold G. Weidenthal, deceased.

A composition of matter for the manufacture of permanent molds for metal founders' use consisting essentially of calcined bauxite crushed to graded sizes, graphite and a binder consisting largely of raw pulverized bauxite and water.

1,402,644. January 3, 1922. **Soldering of Aluminum.** Augusto Passalacqua, of Paris, France.

The object of the present invention is a process of soldering aluminum which is effected in the following manner:

First of all a paste is prepared consisting of a mixture of linseed oil, olive oil, resin, paraffin, solid fat. Any proportions may be used for compounding this mixture, which is effectea in the warm.

1,402,015. January 3, 1922. **Treating Brass Scrap.** Oliver C. Ralston, of Niagara Falls, N. Y., assignor to Hooker Electrochemical Company, of New York, N. Y.

This invention relates to a novel process for the treatment of brass scrap and similar copper-bearing alloys, the object of the invention being the provisions of a simple and economical process whereby the zinc and copper values may be recovered, primarily in the form of chlorids.

1,403,005. January 10, 1922. **Method of Casting.** William C. Bowers, of Newark, N. J., assignor to American Abrasive Metals Company, of New York, N. Y.

This invention relates to the manufacture of metal castings having a protective or wear-resistant surface, such as in stair treads, floor plates, trench or gutter covers and the like, wherein bodies or particles of hard wear-resistant material are embedded in a metal body or casting so as to be exposed on the surface thereof; and this invention consists of an improved, simple and effective method of casting by which the hard wear-resistant bodies or particles will become firmly fixed and embedded in the process of casting, and will form on the face of the same a protective wear-resistant surface.

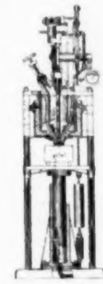
1,403,380. January 10, 1922. **Electrode for Use in Depositing Molten Metal and Process or Method of Making Same.** William Hanson Boorne, of London, England.

This invention relates to metal electrodes used for the depositing of metal by the electric arc and in particular to an improved coating for the metal rod or rods which form the core of the electrode.

1,403,230. January 10, 1922. **Metallic Arc Welding.** Jack Churchward, of New York, N. Y., assignor to Wilson Welder and Metals Company, of New York, N. Y.

This invention relates to electric arc welding, and particularly to that type of welding known as "metallic-arc welding" wherein the metal to be deposited is supplied from the electrode itself.

One object of this invention is to produce a simple and efficient method of depositing metal from one metallic electrode upon another, in such a manner that the deposit will have a definite predetermined chemical composition. Another object is to produce a method of securing metallic deposits of any desired composition with great accuracy, rapidity and cheapness.

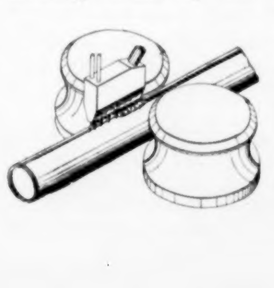


1,403,266. January 10, 1922. **Die-Casting Machine.** Gabriel E. Rohmer, of Brooklyn, N. Y.

This invention relates to die casting machines having for its object to provide a commercially practicable apparatus particularly for use in the manufacturing arts of die casting non-ferrous metals, such as lead, tin, zinc, antimony, aluminum, etc., and their alloys, using compressed air as a pressure agent.

1,402,966. January 10, 1922. **Method of Welding.** James L. Anderson, of Bayonne, N. J., assignor, to Davis-Bournonville Company, of New York, N. Y., a corporation of New York.

Improvement in the method of progressively butt-welding seams by the application of the intensely heated points of rows or lines of autogenous welding jets at opposite sides of the seam removed from the edges, to fuse the edge regions and cause them to flow together, characterized by the application toward the rear of said jets of one or more finishing jets acting substantially in the central longitudinal line.



EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

Melting Metal in Crucibles

By THOS. H. A. EASTICK

The use of crucibles for melting metals dates back hundreds of years, yet today the finest grades of steel and non-ferrous metals are melted in them. It is sometimes thought that the almost universal use of crucibles is merely a survival of old-fashioned ideas and is an evidence of conservatism on the part of the practical foundrymen. This article will have served a useful purpose if it does no more than, to some extent, at least, dispel this fallacious idea.

The valuable features of crucible practice, some of which are unique, may be summarized as follows:

Convenience of Handling. Melting metals in crucibles obviates the necessity for transferring metal from one vessel to another before casting. Inasmuch as the production of good castings involves far more than merely melting metals, the elimination of such transfers of molten metal means cleaner castings, proper pouring temperatures and freedom from entangled oxides and blowholes. Of course, where very large castings must be made, it becomes necessary to either arrange the furnace to pour directly into the mold or to use ladles. Such conditions are exceptional, however.

Shape of the Crucible and the mass of metal are such that the possibility of contamination from dissolved gases is reduced to a minimum.

No refractory material is as good for the purpose as that from which crucibles are made. There is no slagging, etc., which invariably accompanies other methods of melting.

BETTER HEAT APPLICATION

The use of a crucible, which is not an integral part of the furnace, allows heating to take place through the bottom and sides instead of the top only, thus eliminating overheating and burning, besides reducing zinc loss and obtaining better efficiency from the fuel burned. Heating metal in a crucible from the bottom promotes convection currents which effectually prevent a very hot surface and a cold bottom, which is a prolific source of difficulties, bad castings and high losses.

Melting in small unit charges offers many direct and indirect advantages. By far the majority of brass and copper castings are less than two or three hundred pounds in weight and can therefore be readily cast from small crucibles. It is, therefore, advantageous to melt in small unit charges on account of the greatly lessened risk of spoiling a large quantity of metal either through the use of impure materials or improper manipulations. It is a serious matter when a large charge of a ton or so of metal has to be rejected and scrapped.

Crucible melting equipment is comparatively inexpensive, and this fact is of the greatest importance. High initial investment means high overhead, heavy depreciation expense and a heavy loss, should business conditions change and the particular type of expensive equipment become useless.

These features are, of course, known in a general sort of way and are the basis of the great success of crucible practice over so many years. Under stress of modern competition accompanied by high labor and fuel costs, many manufacturers have been endeavoring to find some way to improve the standard coal-fired pit furnaces. By far the most successful efforts in this direction have been the introduction of oil and gas fired crucible furnaces, in which, owing to the higher form value of these fuels over coal, the element of labor cost has been greatly reduced. The use of these types of furnaces has considerably reduced the labor cost and at the same time all the unique advantages of crucible practice have been retained.

Oil and gas fired crucible furnaces are of two general types, namely, tilting crucible furnaces in which the crucible is not removed from the furnace when pouring, and the stationary crucible furnace in which the crucible is removed for pouring usually in a similar manner to the standard coal fired pit furnace. Each of these two types of crucible furnaces has a field of usefulness and the suitability of each depends entirely on local conditions. Tilting furnaces are eminently suitable where charges in excess of 250 to 300 lbs. are to be melted. The stationary type is adapted to all conditions where coal pit fires are now used.

Many foundrymen, owing to their unfamiliarity with oil or gas fuel and the mechanical appliances required to burn them, are apt to hesitate about the use of such fuels in their shops. There is no risk involved providing the equipment is properly installed by someone who knows his business. A few suggestions to those about to install oil or gas fuel fired crucible furnaces and to those who now operate such equipment may be of interest.

INSTALLATION OF MELTING EQUIPMENT

The proper installation of oil burning furnaces and the necessary auxiliary equipment is a problem requiring expert engineering skill. In some cases furnace manufacturers and contractors will design and install all equipment and piping, etc., and in others it may be necessary to have an engineer do this work.

The oil storage tank should be located underground convenient to railway siding or road, depending on whether oil is to be delivered in cars or lorries. It should contain a steam heating coil, especially in cold climates, or should be located in a warm place. The oil tank should be anchored to some secure foundation and should be properly vented and careful pipe-fitting should be insisted on.

The oil pump should be of sufficient capacity to amply supply all oil required at a pressure of from 30 to 60 lbs. per square inch.

The tank and pump should be located as near the furnaces as is convenient to avoid pumping oil long distances. The piping should be of such size as to allow a fairly rapid flow of oil so that in cold weather the oil will not become chilled or sluggish on its way from the tank to the furnace. It is most essential to have an efficient filter in the line to remove dirt and dust, and in many cases it is advisable to have an oil heater so that oil may be delivered to the burners at low viscosity.

A safety device which is of value is some sort of check valve or similar arrangement whereby if the air supply fails the oil is automatically shut off.

The air supply also requires careful design. There seems to be some confusion in the minds of some as to the terms "volume" and "pressure." With low pressure type burners, the air pressure is of no importance other than to force the required **quantity** (volume or weight) through the pipes. The higher the pressure, the smaller the pipe may be to convey a given volume of air per second or minute. It is generally convenient to deliver air to the furnace at a pressure of about 1 lb. per sq. in. (about 2" mercury).

Low pressure type burners which are invariably used with furnaces of this character, are merely valves for the introduction of fixed quantities of air and oil into the furnace. The mixing and gasification of the oil and the combustion all take place inside the furnace itself. The important feature is to introduce sufficient air into the furnace to burn the oil; the pressure at which the air enters the furnace is immaterial. Higher pressures than necessary result in rapid deterioration of the crucible and the brickwork and waste of power.

The size of burner to use depends on how many B. T. U. per minute are required to be generated in the furnace to do the work. From this it is readily determined how much oil must pass through the needle valve of the burner per minute. Having determined this it is then easy to calculate how much air must be introduced into the furnace per minute

to burn the oil. The pressure at which to deliver the air depends on what size piping and air conduits it is convenient to use. The air is not required for "atomization" purposes in the low pressure types of burners as it is with high pressure types which are sometimes used for steam boilers, etc.

The best form of apparatus for pumping air to the furnace depends on local conditions. The types of equipment usually used are the positive pressure blower or the centrifugal fan. A well designed and constructed centrifugal multi-stage fan delivering air at a pressure of about 1 lb. pressure possesses many advantages. There is a saving in power over the blower type, and much less noise and lower upkeep. The air is also delivered free from pulsations and there is no necessity for a receiver or "air box." There is also no danger from burst pipes or break-downs due to failure of the relief valve to work when all the burners are shut off.

The most prolific source of trouble with oil fired equipment is the fact that few furnace operators are properly instructed in the regulation of air and oil, which is perfectly simple when the principles are made clear and proper instruction is given. It would well repay those operating fuel oil equipment to get an expert to spend a day or so in their shop giving proper instruction to the operators. The savings in fuel and improvement in production and quality of the metal are sometimes astonishing.

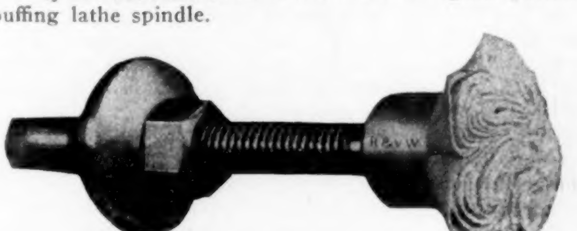
Sometimes poor results may be traced to defective installation; dirty oil, cold oil, improper setting of burner and burner plate on the furnace, insufficient air and air at too high pressure are among those conditions which cause much trouble and yet may be easily remedied.

Care should be taken in the selection of brick and clay for re-lining crucible furnaces when necessary. Only the highest grade of brick should be used and as little clay as possible should be used between bricks when laying. Judicious patching with high temperature cement will result in re-lining economies. At the end of the day's work, the crucible should be put in the furnace and the furnace tightly closed. Also during the operation of the furnace it should be kept closed as far as possible to prevent cold air striking the lining. Whenever the oil is shut off the air should be shut off also. The sudden expansion and contraction of the brick work will inevitably shorten its life.

Too much cannot be said on the subject of care of crucibles. Crucibles with proper care and use will give more heats with oil or gas fired furnaces than with coal fired furnaces. They won't last more than about two heats, however, if they are taken out of the barrel and plunged into a red hot furnace as, unfortunately is sometimes done. The writer has personal knowledge of No. 100 crucibles lasting an average of 30 heats in oil fired stationary furnaces with some giving up to 36 heats.

NEW HOLLOW-WARE BUFF CHUCK

The illustration shows a hollow-ware buff chuck manufactured by The Hanson & Van Winkle Company. These are said to be extremely useful tools for polishing and coloring all kinds of hollow-ware, lamp reflectors, bowls, cups, pitchers, etc. They are used attached to the end of a regular polishing or buffing lathe spindle.



HOLLOW-WARE BUFF CHUCK

Size No. 1 forms a buff about 2¼ in. face with a crowned cushion about ¾ in. deep and takes for polishing: 1 section of 4 in. dia. 18 piece unbleached muslin buff with 7-16 in. hole. For coloring: 1 section of 4 in. dia. 10 piece canton flannel buff with 7-16 in. hole.

Size No. 2 forms a buff about 4 in. face with a crowned cushion about 1¼ in. deep and takes for polishing: 2 sections of 5 in. dia. 18 piece unbleached muslin buffs with 7-16 in. hole. For coloring: 1 section of 5 in. dia. 18 piece canton flannel buff with 7-16 in. hole.

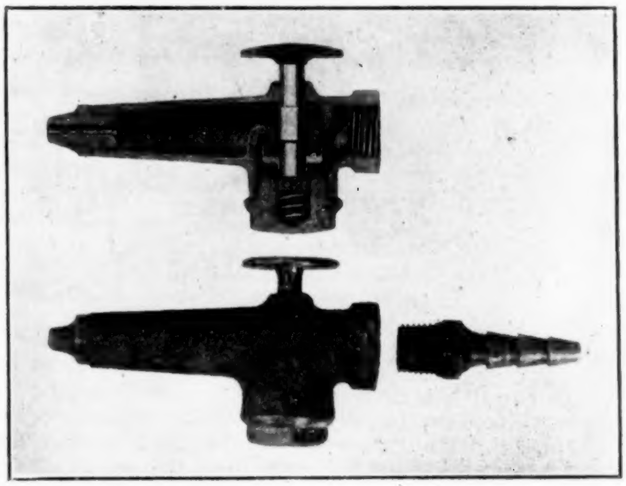
These chucks are regularly made fitted with filister head screws 7-16 x 16 (right-hand only) and will fit the Hanson & Van Winkle Company polishing and buffing lathes of the following sizes:

No. 2	No. 10
No. 3	No. 11
No. 4	12 inch

The buff and chuck is attached to the lathe spindle by slipping the screw stem through the buff, then through the chuck and screwing tight into the tapped hole made to receive the stem of the detachable tapered screw point. This draws the buff into the chuck, forming a firm crowned-end buff.

NEW BRASS AIR GUN

Air when compressed and converted into a form of energy and power ceases to be "free"; fuel, machinery, equipment, and labor enter into making it an item of cost. And cost of compressed air greatly rises, through any waste by leakage, before final distribution to the tool which it operates or to the points of its ultimate use. Due to leakage through joints in piping, valves, split pipe, defective castings, and wastage at a tool or machine, the over all efficiency of compressed air is very often reduced 40 to 60 per cent throughout the system.



JENKINS AIR GUN

Jenkins Brothers, manufacturers of Jenkins Valves, are now marketing a brass air gun, which, it is claimed, is air-tight, and an assurance against costly air waste. The disc forms a perfect contact on the seat and takes up the wear of frequent usage. The disc gives long service, but can be easily and quickly renewed, if necessary.

The Jenkins air gun is said to be finding wide use in foundries for blowing off cores, cleaning core boxes, flasks, patterns, and for general dusting; in machine shops for blowing off chip boring filings, trimmings, and for cleaning tools, tops, dies, etc.

PYROMETERS

A line of pyrometers and thermometers known as K. & S. instruments are being marketed by the Arthur Sachsse Corporation, 6 East 32nd street, New York. These include a type of particular interest, called Fully Compensated Pyrometers (patented) which it is claimed, always register the correct temperature no matter what the temperature of the

cold end of the thermocouple may be. Several types of pyrometers are obtainable, running up to 1600°C.

Special types of thermocouples are used, varying with the temperature range and the purpose to which they are to be put.

SUNDH CABLE DRAWBENCH

An interesting new principle has been used in the design of an improved Drawbench recently placed on the market by Sundh Engineering and Machine Company, Philadelphia, Pa.

In the use of drawbenches for the production of rods, tubes, moldings, and bars of various shapes, by cold-drawing them through a die, two types of benches have been predominant, the hydraulic and the chain type, each having its advantages for certain classes of work and also its disadvantages. The cable drawbench is claimed by its manufacturers to afford all the advantages of both types, without the disadvantages of either, and to produce a larger quantity of work in a given time, as well as to reduce the labor cost.

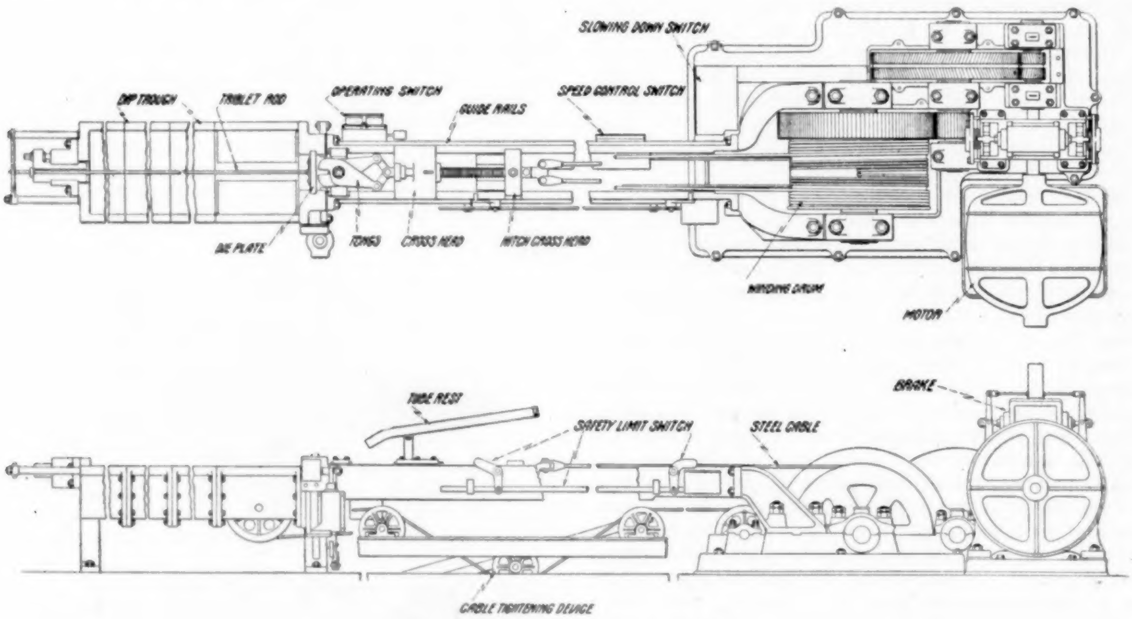
The bench is in effect a horizontal elevator. A pair of tongs for gripping the end of the work and drawing it through the die, is mounted on a crosshead which slides forward and backward along a pair of ways in accordance with accepted practice; but the tongs are operated in both directions by steel wire cables carried over a winding drum which is driven by an electric motor, stopped by an electric brake, and automatically controlled by a simple mechanism which requires practically no attention from the operator.

Although the full list of operating advantages is too lengthy to enumerate here, much of the value of the machine lies in the cycle of operation which is as follows: in drawing a brass tube, for instance, the operator simply slides the tube over its mandrel, inserts its pointed end in the die, and steps on a foot pedal. Automatically, and without further attention whatever, the tongs seize the pointed end, grasp it firmly, draw it at slow speed for a few inches, accelerate rapidly to high speed, and continue until the other end of the tube has passed through the die. Thereupon they instantly release the tube, dropping it by gravity upon inclined carriers, which roll it out of the machine into slings, ready for carrying away with a crane. Simultaneously the tongs come to a stop, reverse, and return at high speed to the die head, where they are automatically retarded, stopped, and opened to receiving position by the electric controlling device.

During the period of drawing, it is stated that the operator is free to confine his whole attention to preparing the next tube. The net result is increased efficiency, and a much larger production of tubes in any given time, both per machine and per man.

While economy is the chief claim of the builders, it is also that the cable drawbench lends itself to some ingenious improvements. For instance, since the tongs are never unhooked from the pulling mechanism, as in a chain drawbench, the work is not subjected to any sudden jerks at the start of each draw. In like manner, the use of an accelerating control makes it possible to employ higher drawing speeds than those permissible on a chain bench. Another interesting feature is the self-adjusting stroke, for no matter what be the length of the tube, whether long or short, the tongs are automatically reversed without unnecessary lost motion.

The cable drawbench has it is stated, been thoroughly tried out on various classes of work under commercial conditions, in an established tube mill, and using the regular class of laborers, and in actual practice has proved fully up to expectations. Rights to the machine itself are protected under patents of the inventor, August Sundh; electric controlling devices are introduced by permission of Otis Elevator Company; the gravity delivery is used under a license from the patentee of that feature, W. R. Webster, Vice President of Bridgeport Brass Company; and additional applications are now pending.



THE SUNDH CABLE DRAWBENCH.

NEW JEWELER'S HOME OR SHOP OUTFIT

Many jewelers, either in their shop or at home, require the use of a drill press in addition to their workbench and in order to meet this demand in an economical manner, Leiman Brothers, 81 Walker street, New York, have evolved this little outfit. A Regulation Workbench, their latest style with the non-splitting, non-curling top is used. On it is mounted their new swivel motor drills. In this drill press the motor forms the swivel base and the drill chuck can be moved in a circle to the center or either side of the bench. The little round table or face plate may be raised or lowered and the chuck is raised and lowered by means of the counter-balanced feed handle on top. The chuck is not a spring-jaw device but the highest grade threaded-jaw chuck which will hold accurately any drill from 3/16 inch to No. 80 or finer.

The outfit further consists of a jeweler's workbox with inside container, and electric bench lamp, less the bulb itself and a jeweler's chair with a back all reinforced and strengthened by means of wire stays binding the back and legs securely to the seat.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS 140 SOUTH DEARBORN ST., CHICAGO, ILL.

Those who have not sent in their tentative application for space at the Rochester exhibit, the week of June 5, giving the approximate number of square feet you will require, and the depth of booth you prefer, are asked kindly to do so at once. In response to the bulletin of January 26, there have been received to date applications totaling 21,567 square feet, a little more than two-fifths of the entire space available in the three buildings. The above figures do not include 48 firms from whom letters were received saying that they wished to be represented, but who did not enclose applications giving their approximate space requirements, and with nearly 150 of last year's exhibitors yet to be heard from, it will be seen that the buildings must be planned to the best possible advantage in order to accommodate all.

BRITISH INSTITUTE OF METALS

HEADQUARTERS, 36 VICTORIA STREET, WESTMINSTER, LONDON, ENGLAND

The annual general meeting will be held in the House of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W. I., on March 8 and 9, 1922. The technical program is as follows:

WEDNESDAY, MARCH 8TH. (MORNING SESSION, 10 A. M. TO 1 P. M.)

"Notes on the Corrosion and Protection of Condenser Tubes." By G. D. Bengough, M.A., D.Sc. Member (Investigator to the Corrosion Research Committee).

WEDNESDAY, MARCH 8TH. (AFTERNOON SESSION, 2.30 P. M. TO 4.30 P. M.)

"The Internal Mechanism of Cold-Work and Recrystallization in Cupro-Nickel." By Frank Adcock, M.B.E., B.Sc. Member (Teddington).

"The Effect of Impurities on Recrystallization and Grain Growth." By the Research Staff of the General Electric Company (London). (Work conducted by Major C. J. Smithells, M.Sc.)

"Further Studies in Season-Cracking and its Prevention. Condenser Tubes." By H. Moore, O.B.E., Ph. D., F.I.C., Member, and S. Beckinsale, B.Sc. Member (Woolwich).

THURSDAY, MARCH 9TH. (MORNING SESSION, 10 A. M. TO 12.30 P. M.)

"The Rate of Combination of Copper and Phosphorus at Various Temperatures." By Professor C. A. Edwards, D.Sc., Member of Council, and A. J. Murphy (Swansea).

Note on "Some Cases of Failure in 'Aluminum' Alloys." By W. Rósenhain, D. Sc., F.R.S., Vice-President (Teddington).

"Some Mechanical Properties of the Nickel-Silvers." By Professor F. C. Thompson, D.Met., B.Sc., Member, and Edwin Whitehead (Manchester).

"A Further Study of the Alloys of Aluminum and Zinc." By D. Hanson, D.Sc., Member, and Marie L. V. Gayler, M.Sc., Member (Teddington).

Note on "The Assay of Gold Bullion." By Arthur Westwood, Member (Birmingham).

INDIANAPOLIS BRANCH, A. E. S.

HEADQUARTERS CARE OF LOUIS MERTZ, 1728 UNION STREET, INDIANAPOLIS, IND.

On February 11, 1922, a regular meeting and smoker was held which was well attended. Only necessary routine work was gone through, the rest of the time being taken up with smoking, drinking good cider and eating doughnuts. Mr. Haas, formerly of New York, who was with us made some remarks and said he expected to see us some more in the future as he is now located near us. Mr. Humphries of the Udylite Process Company, of Kokomo, spoke on the rust proofing of iron and steel with the different methods, such as hot and cold galvanizing, sherardizing, parkerizing, etc., explaining the different processes gone through and the wearing qualities and durability. He then explains the Udylite process which is coating the metal with cadmium in a solution containing cadmium using carbon anodes then baking the plated article at a high temperature which converts the article's surface into cadmium steel or cadmium iron. The subject was very interesting. Two applications were received and one member was reinstated.

AMERICAN ELECTROPLATERS' SOCIETY

HEADQUARTERS, CARE OF J. E. STERLING, 468 GRAND AVS., LONG ISLAND CITY, N. Y.

The next convention of the American Electroplaters' Society will be held in Cincinnati, O., June, 1922.

CLEVELAND BRANCH, A. E. S.

HEADQUARTERS CARE OF B. F. MCCORMICK, 2024 WYANDOTTE AVE., LAKEWOOD, O.

The Cleveland Branch of the A. E. S. held a banquet at the Hotel Winton on February 25, 1922. The program was as follows: Address of welcome by H. R. Doert, organizer of local branch; history of A. E. S., by H. R. Sliter, charter member of N. Y. Branch; a treatise on electro-chemistry as it pertains to the Plating Industry, by W. R. Veazey, Prof. of Chemistry; Case School of Applied Science. Music, songs and dancing featured the evening's entertainment.

MILWAUKEE BRANCH, A. E. S.

HEADQUARTERS CARE OF R. STEVERNAGEL, 1508 CONCORDIA AVE., MILWAUKEE, WIS.

The Milwaukee Branch, A. E. S., will hold their next banquet on Saturday, March 18, 1922, at the Milwaukee Athletic Club, corner Mason and Broadway, at 7:30 P. M. All platers, whether they are members or not, are cordially invited to attend, also the representatives of all manufacturers who may be interested in this work, as there has been a very attractive program prepared for this occasion.

Interesting speakers will deliver addresses, there will be excellent papers, and all interested in the deposition and finishing of metals should take advantage of this. The committee in charge are D. Wittig, P. Sheehan, Hazucha, Frank Marx, G. Gehrke and R. Steuernagel.

ST. LOUIS BRANCH, A. E. S.

HEADQUARTERS, CARE OF H. H. WILLIAMS, 4156 BOTANICAL AVE., ST. LOUIS, MO.

The program as arranged last September is being followed at each meeting. Members specially assigned to subjects have responded well and they have taken an active part in the discussions. Our Librarian, Geo. Lamkemeyer is always on the job and keeps things lively. Question cards are always in order, and interest never lags.

Our annual banquet held in January was a success; it could not be otherwise when our committee had for its chairman E. J. Musick, who is just as systematic in running a banquet as he is in his business.

Frank Rushton who had returned from Mexico City "just in time" gave an excellent talk on Mexico. Several of our large concerns were represented.

President C. T. McGinley had been under the doctor's care, but he refused to stay home.

Belleville and New Athens were well represented by C. J. Koderhandt and L. M. Hofmeister.

We are now looking forward to the Cincinnati Convention.

AMERICAN ELECTROCHEMICAL SOCIETY

HEADQUARTERS CARE OF DR. C. G. FINK, 101 PARK AVE., NEW YORK

BALTIMORE MEETING, APRIL 27, 28 AND 29

The headquarters and registration bureau for the Spring meeting of the society in Baltimore, will be at the Hotel Emerson, corner Calvert and Baltimore streets.

The technical sessions will be held Thursday, Friday and Saturday mornings and will include three symposiums: Electric furnace cast iron, gases of the electrochemical industries, and electromotive chemistry. Preparations for these sessions have been pregressing steadily and under the capable guidance of their respective chairmen: Mr. A. T. Hinckley, Mr. W. S. Landis and Dr. Wm. C. Moore, a splendid program is anticipated.

Mr. Wm. H. Boynton and his local committee on arrangements are sparing no effort or time in completing preparations that will be interesting and enjoyable to everyone in attendance. The plans under way provide for visits to industrial plants, a complimentary smoker to be given by the chemists and engineers of Baltimore, a golf tournament, a boat trip, an illustrated lecture by Prof. W. R. Wood on "Fluorescence," and an entertainment program for the ladies.

Further specific details will be published in subsequent bulletins and program.

SOCIETY FOR TESTING MATERIALS

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

Standards have been approved by the Engineering Standards Committee of the Methods of Chemical Analysis of Manganese Bronze (B 27-19) and of Gun Metal (B 28-19).

CORROSION COMMITTEE

The National Research Council, through its Division of Research Extension, has recently organized a Committee on Corrosion of the following personnel:

W. M. Corse, chairman	G. K. Burgess
W. D. Bancroft	D. M. Buck
W. H. Bassett	C. G. Fink
E. M. Chamot	John Johnston

The purpose of the committee is, first, to correlate in a general way all corrosion studies that are being undertaken at the present time in various organizations; and second, to study corrosion from a more fundamental viewpoint than that which actuates most investigations—in other words, to seek the answer to the question: "What and why is corrosion?" The committee will not undertake such investigations as those of Committee A-5 on Corrosion of Iron and Steel or of the proposed Committee on Corrosion of Non-Ferrous Metals and Alloys. The Research Committee will be kept informed of the work of these two committees through D. M. Buck and W. H. Bassett.

The Executive Committee of the A. S. T. M. has authorized the appointment of a new standing committee to be known as Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys.

A representative committee of producers and non-producers will be organized at an early date under the temporary chairmanship of Vice-President George K. Burgess.

Committee D-14 on Screen Wire Cloth has prepared a draft of Specifications for Non-Ferrous Screen Wire Cloth, which has been circulated among its members for criticism. The question as to the proper naming of wire cloth will be taken up with Committee E-8 on Nomenclature and Definitions and Committee B-2 on Non-Ferrous Metals and Alloys. The next meeting of this committee will be held in March.

DETROIT TECHNICAL SOCIETIES

HEADQUARTERS, CARE OF E. S. REID, 740 VIRGINIA PARK, DETROIT, MICH.

After several years of thought and discussion along similar lines, the movement for the affiliation of the architectural, engineering and other technical societies of Detroit was taken up seriously in June, 1921, by the organization of a Temporary Council composed of two delegates from each of the several societies interested. The affiliation has become an accomplished fact, taking effect January 1, 1922, by the ratification of the proposed Constitution and By-Laws, acceptance of membership, and election of Councillors by the following twelve societies: Detroit Section, American Society of Civil Engineers; Detroit Chapter, American Association of Engineers; Michigan Chapter, American Society of Heating and Ventilating Engineers; Detroit Post, Society of American Military Engineers; Detroit Section, American Society of Mechanical Engineers; Detroit-Ann Arbor Section, American Institute of Electrical Engineers; American Institute of Chemical Engineers; Detroit Engineering Society; American Chemical Society and Detroit Chemists; Michigan Chapter, American Institute of Architects; Detroit Section, Michigan Society of Architects; Detroit Chapter, American Society for Steel Treating

The permanent Council met and organized December 13, 1921, and elected officers for 1922 as follows: Chairman—P. W. Keating; Vice-Chairman—A. A. Meyer; Secretary-Treasurer—Walter R. Meier.

NATIONAL SAFETY COUNCIL

HEADQUARTERS, 168 N. MICHIGAN AVE., CHICAGO, ILL.

Although it is known that the metalworking industry has, because of the inherent hazards of its nature, always been among the leaders in industrial safety, it has never been established definitely how many persons in the metalworking industry are engaged in accident prevention and industrial health work, or how this industry compares with other industries in this respect. All this will soon be shown when a census of safety men in the metalworking industry, which is now being taken by the National Safety Council along with the census of safety men in all other industries and in public safety work, is completed. The census will include not only members and employees of members of the National Safety Council, but all persons engaged in safety and industrial health activities and not connected with the Council at all.

Every reader of this publication who is professionally engaged in industrial or public accident prevention or industrial health work—whether he is devoting all or only part of his time to accident prevention—is urged to assist in the taking of this census by sending to the National Safety Council, 168 North Michigan Avenue, Chicago, for a form to fill out.

MECHANICAL ENGINEERS

HEADQUARTERS, 29 W. 39TH ST., NEW YORK

The American Society of Mechanical Engineers has taken a new step in issuing the A. S. M. E. News. Issued twice a month, it will increase the effectiveness of the employment service and offer much better facilities for publishing news regarding the ever-growing activities of the Society. It is planned as a publication for the service of Society members and will provide means of greater intercourse.

Part II, the Society Affairs Section of Mechanical Engineering, has been abandoned and its function will be fulfilled by the semimonthly issue of the A. S. M. E. NEWS.

AMERICAN ENGINEERING COUNCIL

HEADQUARTERS, 29 W. 39TH ST., NEW YORK

Rounding out a year of improved organization, substantial accomplishment and strengthened purpose, the American Engineering Council of the Federated American Engineering Societies held its first annual meeting at the Cosmos Club, Washington, January 5 and 6, Dean Mortimer E. Cooley of the University of Michigan, president of the Council, presiding. Officers were chosen, the work of the past year reviewed and discussed, action taken on important matters of public and technical service, new financial arrangements put into effect, committees named, new policies sanctioned and old ones reshaped, and a broad and definite program outlined for the next twelve months. A leading event of the meeting was a dinner in honor of Herbert Hoover, who, addressing the members of the Council and their guests at the

University Club, praised the work of the Committee on Elimination of Waste in Industry as a great and lasting public service, pointed the way for new engineering effort in the public interest, and expressed renewed devotion to the ideals of the Council. Resolutions of appreciation of the service of the new Secretary of Commerce were presented to Mr. Hoover.

PERSONALS

I. D. Adams has opened an office at 204 Seitz building, Syracuse, N. Y., as manufacturers' agent (not a jobber) for a complete line of foundry equipment and supplies. He will also represent the E. Reed Burns Manufacturing Corp. with a complete line of platers and polishing supplies in the state of New York outside of the metropolitan district.

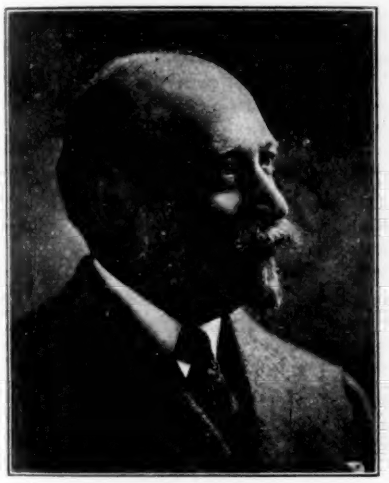
F. C. Rushton, who was for several years secretary of the St. Louis branch of the A. E. S., has returned to St. Louis after an absence of two years in Mexico. Mr. Rushton will represent the St. Louis Platers' Supply Company, in the Chicago territory. He was formerly connected with the A. P. Munning Company, and served in the world war in which he was wounded.

Deaths

GEORGE WILLIAM PECK

George William Peck, age 62, of the Miner and Peck Manufacturing Company, of Derby, Conn., died at his home February 1, 1922, of acute kidney trouble.

The Miner and Peck Manufacturing Company was established in 1850 by his father under the name of Milo Peck. At the death of his father in 1876, Mr. George W. Peck assumed active managership and continued as manager until his death. During his lifetime the concern was renamed Milo Peck and Company, Beecher and Peck, and the Miner and Peck Manufacturing Company.



GEORGE WILLIAM PECK

In November, 1920, the company was purchased by the Birmingham Iron Foundry and removed to their plant at Derby, Conn., Mr. Peck being installed as manager, and the company retaining its name of the Miner and Peck Manufacturing Company. The large works and facilities of the purchasing company, together with its engineering staff working in co-operation, greatly increased the capacity of the Miner and Peck Manufacturing Company.

Mr. Peck in his years as manager had continually developed the design of the "Peck" Drop Press and the "Peck" Automatic Lifter which was his father's invention. He was well known and respected in the trade and his passing will be regretted by a wide circle of friends. Mr. Peck was a resident of New Haven and was a member of the General Society of Mayflower Descendants, Sons of the American Revolution, Economic Club, and the New Haven Colonial Historical Society.

Mr. Peck was a contributor to THE METAL INDUSTRY, having written the following articles: Foundations for Drop Presses, January, 1911, and an article of the same title in January, 1912.

GUY L. MEAKER

The untimely passing last August of Guy L. Meaker at his home in Joliet, Ill., shocked a large circle of friends. Born in Detroit, Mich., in 1873, he moved to Wellington, Ohio, when a small child, and received his education through the High School there. He was always a student and early became interested in chemical and electrical subjects. While in the manufacturing business with his father near Chicago, he continued his education along professional lines by correspondence courses. His attention became centered upon electro-chemical branches and he was considered an expert in electro-deposition of zinc. With his brother he established the Meaker Galvanizing Company in Chicago, of which he was president for many years.

Mr. Meaker was for a term of years connected with the American Steel and Wire Company, holding the position of assistant superintendent of the Rockdale plant at Joliet. During that time he improved their hot galvanizing methods, and at the time of his death he was looked upon as a specialist in these lines.

About twelve years before his death Mr. Meaker lost his eyesight, but in spite of this affliction he continued his study and investigations so far as was possible under the circumstances, and to the end of his life he was an example of courage to those associated with him.

In 1908 he married Miss Cornelia Wilcox, daughter of J. Frederick Wilcox, of Joliet, and he is survived by his widow and two small daughters.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

MARCH 1, 1922.

As a result, it is believed, of the recent petition in bankruptcy filled by **Robert Ingersoll & Brother,** watch manufacturers, the **Waterbury Clock Company,** which formerly manufactured a large quantity of the watches which the Ingersoll company distributed, has launched a campaign to distribute its products itself. Advertising will shortly appear in every national magazine of any importance, of the seven models of watches made by the Waterbury Clock Company, and arrangements will have been perfected whereby the models will be placed in the hands of retailers through regular jobbing channels. To this end, the clock company has already taken over several of the ablest members of the Ingersoll sales force.

The local branch of the Ingersoll company, formerly known as the **New England Watch Company** and still earlier as the **Waterbury Watch Company** appears to have been little affected by the petition in bankruptcy filed. Although it has been running with a reduced force the same as most factories for over a year, it has not manifested any tendency to shut down altogether, but continues to operate in spite of the bankruptcy of the parent concern.

The recent report of the creditors' committee of the concern that the assets would have to be sold, due to its inability to work out a satisfactory reorganization plan has led to the belief that possibly the **Waterbury Clock Company** might

buy the assets which were to be sold February 27. The clock company officials declined to state whether there was any truth to this, declaring that the affairs of the Ingersoll concern with relation to the clock company were in a very unsettled state and would likely remain so for some time.

The election of officers and directors of the **American Brass Company** was held this month, after the transfer had been effected of 97 percent of the stock to the **Anaconda Copper Company.** All the old officials were re-elected, the only changes being the addition of three Anaconda officials to the board of directors: **John D. Ryan, Cornelius F. Kelley** and **Benjamin Thayer.**

The annual meeting of the **Scovill Manufacturing Company** elected the following officers: President, Edward O. Goss; vice-president, John H. Goss; treasurer, C. M. DeMott; secretary, L. P. Sperry, assistant, T. B. Myers; assistant treasurer, F. J. Gorse. These together with William E. Curtiss, M. L. Sperry, F. J. Kingsbury, W. S. Fulton and C. P. Goss, Jr., constitute the board of directors.

William H. Bassett, of this city, metallurgical engineer of the American Brass Company, was recently elected a director of the **American Institute of Mining and Metallurgical Engineers.**

Many of the local industries show signs of improvement as orders for Spring trade come in. The Scovill Manufacturing Company is busier than it has been for many months. The Waterbury Clock Company shipped out thousands of clocks last week and is now working on a five and one-half day schedule. The Waterbury Manufacturing Company has more men at work than it has had in a year. The Oakville Company and the American Brass Company are both reported to be busier than in a long time. The banks report that money is much looser today than it has been in more than a year.

If the suggestion recently made at the city board of finance meeting a short time ago is adopted, much of the local manufacturers' idle money may be put to work in the city government which will be compelled to make many temporary loans before the May taxes come in. John H. Goss, of the Scovill Company, who is a member of the board of finance, suggested that possibly the money needed by the city could be obtained from the local factories at less interest than from banking houses and a committee is now investigating the possibility.—W. B.

BRIDGEPORT, CONN.

March 1, 1922.

Although receivers have been appointed for one of the leading industries, the **Locomobile Company,** and application made but dismissed for receivers for another leading industry, the **Columbia Graphophone Manufacturing Company,** business in these plants as well as in others in the city is about at the same level as last month, neither better nor worse, but with an outlook for better conditions in the future.

In an attempt to relieve the unemployment situation, members of the various engineering societies of the city, with the cooperation of the **Chamber of Commerce** have established an employment bureau which they intend to extend to include the whole of Fairfield county.

The unemployed members of the societies have met and organized in the conference room of the Chamber and are now conducting a survey of the various industries in the city. The city is also planning to take a hand in the unemployment situation, through the putting to work on city projects of such men as are willing to do common labor. It is estimated that $60,000 a month will be needed to supply the unemployed with work and Director Coughlin has advanced a plan for using the money for paving purposes on the city's principal streets and for other improvements badly needed. The men would be hired by **Angus P. Thorne,** of the Charities department.

The annual mid-winter banquet of the executives, division heads and foremen of the **Remington Arms Company, Inc.,** was held February 23, in the Stratfield Hotel with an attendance of more than 175. Jarvis Williams, Jr., vice-president of the concern was toastmaster; I. S. Bettes, vice-president of the New York branch; H. J. Strugnell, sales manager of New York; W. G. Shelton, of the cutlery sales promotion department of New York, and Owen Bruns on the retired staff after 47 years' service were the speakers.

TORRINGTON, CONN.

March 1, 1922.

Frederick L. Braman has been reappointed vice-president of the **American Brass Company** for the Torrington branch.

George H. Atkins, who was for over 50 years associated with the **Turner & Seymour Manufacturing Company,** will be retired as deputy judge of the Torrington borough court on March 28 by reason of age limitation. Judge Atkins will be 70 years old on that date. In spite of his age, he is still in active service and is secretary of the Litchfield County Employers' Association, which is composed largely of the manufacturers of Torrington.

The **Community Co-operative Company,** organized during the war period by employes of the local manufacturing plants to deal in groceries, etc., showed a loss of $7,649.04 during the past year, according to the reports read at the recent annual meeting.

Mrs. George Westerman, 57, died February 11, following an operation performed at Rochester, Minn. She was the wife of **George Westerman,** who is a foreman at the Torrington branch of the American Brass Company, and who has been prominent in brass manufacturing circles for many years. The surviving relatives are the husband, three daughters and a son.

A storehouse of the **Trumbull, Vanderpoel Electric Manufacturing Company,** of Bantam, together with two adjoining buildings were destroyed by fire on the night of February 5 with a loss of approximately $25,000. The Torrington fire department was called upon for aid as the flames threatened the entire Trumbull, Vanderpoel plant. William Flaherty was arrested on a charge of arson as a result of the blaze. He is being held for the superior court under bonds of $2,000. —J. H. T.

NEW BRITAIN, CONN.

March 1, 1922.

Of principal interest this month, especially among the leading manufacturing concerns of this district, is the announcement that **Charles F. Smith,** chairman of the board of directors of the **Landers, Frary & Clark Company,** has submitted his resignation as chairman of the board of directors of the **New Britain Machine Company.** Ill health is given as the cause for his action. Mr. Smith took over this position but a few weeks ago, when Chairman **F. L. Platt** resigned. The stock of the New Britain Machine company, once a leader in the machine industry, is now at an extremely low ebb and better things had been hoped for under Mr. Smith's direction.

Otherwise, New Britain manufacturing conditions remain practically unchanged, although a slight upward trend may be discerned. The **Stanley Works** at its annual meeting held early in the month, reelected its old staff of officers and voted an amendment to the charter giving the concern the right to increase its capital stock at any time. The **Traut & Hine Manufacturing Company** has also held its annual meeting, but has made no change in its personnel.

Local manufacturers are watching with anxiety the attitude on Congress toward the tariff. Reflecting this, a recent statement by **C. F. Smith,** of **Landers, Frary & Clark,** is significant.

"Business will be good when employment is general. Employment cannot be general when the stores of American cities are filled with goods made in Germany that should be made by Connecticut workmen. The passage of a tariff bill adequately protecting American industries under American valuation plan will mark the beginning of better times."

At the **American Hardware Corporation, the Corbin Screw Corporation, the Russell & Erwin Manufacturing Company** and the **Corbin Cabinet Lock Company there has been a noticeable improvement in business during the past few weeks, but at the present time things seem to be slowing** up a bit.

Other metal manufacturing concerns about the city are about on a par with those already mentioned. While business is fair, it is not brisk. While there is fairly general employment, there are still many unemployed. At this writing the situation looks much the same as it has for the past eight weeks, with manufacturers professing to see the edge of the silver lining.—H. R. J.

ROCHESTER, N. Y.

MARCH 1, 1922.

While manufacturers and the better element of employees are optimistic in prophecy, there is a deep feeling of unrest in a large percentage of those who have been laid off for various causes during the past year. German and English competition in the metal products has been constantly mentioned as a cause for industrial depression here and elsewhere. A Representative in Congress, living not far from this city, was in Rochester a few weeks ago and he is said to have declared that German competition was greatly handicapping his firm's business, not only in the United States but in South America. Consequently Rochester workingmen are quite anxious for Congress to hurry up some sort of tariff legislation that will stimulate business.

Improvement in business is reported at the several plants of the **Eastman Kodak Company,** the **Bausch & Lomb Optical Company,** and **Yawman & Erbe.** The **Rochester Can Company** is operating with almost a full force, while there is a feeling of confidence in better conditions at the **Todd Protectograph Works** and the **Stromberg-Carlson** telephone plant. All of the metal-plating establishments in the city are enjoying a fairly good trade at this time, due to an increase in winter-building and repair work, as inaugurated by the Builders' Exchange and Chamber of Commerce early in the winter.

With the advent of spring and settled weather, a big building boom will begin in this city. A number of large structures have been planned, and it is expected that the demand for copper, brass, aluminum, tin and lead will be stronger than for the past three years. In fact a number of concerns carrying large stocks of these metals have already added to their holdings.—G. B. E.

PROVIDENCE, R. I.

MARCH 1, 1922.

All lines of the metal trades in Rhode Island may consistently be said to be marking time, waiting to see what the turn of the wheel will bring forth in the immediate future. There is no denying the fact that business is dull and that the outlook is not so favorable as could be desired. This is not a pessimistic view of the situation, but the actual condition, notwithstanding which everybody is keeping up a decidedly optimistic spirit in readiness to take full advantage of every available opportunity.

Since the beginning of the new year there has been a general reduction in wages, particularly among the textile lines and this has resulted in an unsettled situation that is seen reflected in all the industrial lines. As the wage cut has affected practically all the textile centres throughout New England, it is probable that some time will elapse before conditions will adjust themselves to anywhere near approaching normalcy. This is always a dull period among the building trades so that little is being contributed from those sources to the metal lines, and noting is to be expected in this connection until Spring opens up.

While tariff experts are discussing ways of reaching an accord on the principles on which the new tariffs are to be based, and it is said that the American valuation plan has been practically discarded, jewelry manufacturers here and in the Attleboro districts of Massachusetts are practically unanimous in their belief that the American valuation offers the best solution of their problem of meeting German competition in their industry, according to recent declarations.

A sterling silver, enamel pencil, the silver being gold-plated, that cost to make in Providence $42.67 a dozen. The German copy is a better article, having a clip, and the enamel deposited way down to the point. It is delivered to the consignee here for $2.06 each, or $24.72 a dozen.

A silver-plated, unsoldered mesh bag, made at Plainville, Mass., at a production cost of $3.50 each, is copied at Pforzheim, Germany, and sold here, duty paid, for $1.78 each.

A white stone brooch made in Gablonz sells in this country at $5.23 a gross, or approximately 3¼ cents apiece. To make a gross requires 4,176 operations and 6,048 pieces of metal, stone and solder, or 41 pieces and practically 28 operations for each finished article. Another fancy stone brooch is laid down in the American market at an even $5 a gross.

The plant of the **R. Plews Manufacturing Company,** Central Falls, is being operated on a full-time schedule, and no reduction of wages is anticipated. The concern is engaged in the manufacture of sheet metal and tin cylinder used in cotton mills.

J. L. Anthony & Company, manufacturers of jewelers' findings, 161 Dorrance street, has commenced the erection of a new manufacturing plant at Ellenfield and Baker streets and Virginia avenue to which they will remove as soon as it is ready. It is to be one-story of brick, mill construction with steel sashes. It will be 132 feet in length and 55 in width.

The **Fales & Jenks Machine Company,** Pawtucket, has purchased a large tract of land adjoining its plant at Dexter and Barton streets, according to a warranty deed that has been filed at the city hall. It is said that the concern, which is one of the few in the metal trades industry that has kept in operation through the period of depression, will build a large addition thereon at an early date.

The **Rhode Island Welding Company, Inc.,** of Providence, has been granted a charter under the laws of Rhode Island to conduct a general welding business, with a capital stock of $100,000 consisting of 500 shares of common and 500 shares of preferred at $100 each. The incorporators are William G. Winsor, Jr., of Pawtucket, and G. C. Winsor and Frederick C. Martin, of Providence.

H. J. Astle Company, 116 Orange street, have been unusually busy the past month installing their Boland systems for polishing, dust collecting, exhausts and coloring departments of the manufacturing jewelry establishments.

During the 35 years that the **Brown & Sharpe Mutual Relief Association** has been in existence its members have mutually contributed to the payment of $214,222.97 in sick benefits and, since 1909, the sum of $30,300 in death benefits, according to the reports that were made at the annual meeting recently held.

The first all-metal monoplane to be made in this country for the United States Government, has just been completed and shipped to McCook Field, Dayton, O., it was announced early the past month by the Gallaudet Aircraft Corporation, of East Greenwich, builders of the plane. It is the first and largest of a series of monoplanes to be built for the Government by the Gallaudet Corp., and has a wing spread of 66 feet, a lifting area of 663 square feet and the construction contains thousands of rivets. A regular air service engine of sixteen cylinders will drive the plane. The plane is constructed of duralumin and was six months in the making.

The **No-Dust Drying Machine Company,** of Providence, has been granted a charter under the laws of Rhode Island by Secretary of State for the purpose of manufacturing, buying, selling and installing pickling, washing and drying machines for industrial plants.—W. H. M.

TRENTON, N. J.

MARCH 1, 1922.

The metal industry firms of Trenton recently had their products on display in the windows of the various stores of Trenton. The merchants allowed the firms plenty of space to show Trentonians and others visiting the city just what was being made in the metal line. The **Skillman Hardware Manufacturing Company, Trenton Emblem Company, Billingham Brass and Machine Company, Jordan L. Mott Company, John A. Roebling's Sons Company** and others had displays of their goods. It was known as Trenton Products Week

and proved a great advertising feature to the manufacturers.

A state organization of sheet metal men was recently organized in Trenton. The following officers were elected: President, Albert H. Rice, Trenton; secretary, Albert Lindholm, Passaic; secretary, Thomas Rogers, Trenton; treasurer, A. B. Friedberg, New Brunswick; directors, Jesse Brown, Cape May; George F. B. Van Orden, Hackensack; Henry Osterle, Irvington; Charles Sampson, Ocean City; J. H. White, Red Bank; W. G. Schrack, Camden. The association will appoint a committee to look after legislative matters.

The committee of creditors of Robert H. Ingersoll & Brother, which operates the Ingersoll-Trenton Watch Company plant at Trenton, has addressed a letter to the holder of the notes, claims and other obligations of the company, in which it says that it is regretfully forced to state that it has been unable to develop any plan looking to the rehabilitation of the business. The assets, therefore, will be sold on February 27.

George Krouse, Inc., of Jersey City, N. J., has been incorporated at Trenton with $200,000 capital to deal in brass and bronze. The incorporators are George Krouse, Joseph Krouse and Ellsworth Doremus, of Jersey City, N. J.

Solar Electric Manufacturing Company, of Newark, N. J., has been incorporated at Trenton with $100,000 capital to deal in electric lamps.

Joseph H. Bailey & Sons Company, Inc., of Millville, N. J., has been incorporated at Trenton, N. J. with $50,000 capital to manufacture metal containers.

Thomas S. Purrington, for more than twelve years office manager of the **Jordan L. Mott Company,** Trenton, died recently in his home in Philadelphia, following a long illness. He was widely known in musical circles. He left Trenton a few years ago to take a position with the Chester (Pa.) Shipbuilding Company.

Charles H. Williams, formerly a member of the firm of **Skillman, Vandeveer & Williams,** manufacturing jewelers of Trenton, N. J., died recently at his home in Trenton. He was 80 years old and was a prominent member of the Masonic fraternity. Mr. Williams retired from business some years ago.

John Edward Ayers, formerly associated with the Jordan L. Mott Company, at Trenton, and now manager of the Jacksonville, Fla., branch of that concern, was married recently to Miss Maxine A. Odum, of Dayton Beach, Fla.

A portion of the plant of the **American Copper Products Company,** Elizabeth, N. J., was badly damaged by fire recently. The blaze originated in the insulation room.—C. A. L.

CLEVELAND, O.

March 1, 1922.

Optimism is the keynote in the Cleveland district at the present time. Furthermore the optimism is founded on a sound basis, and is justified by the course of events during the past month. The preceding statement does not mean that local industries are booming. They are not, neither is such a condition expected, yet the trend has been upward; markets have seemingly strengthened; plants are finding a direct reflection of improvements in both the size and number of orders; and it may safely be said that the beginning of a real return to normalcy is at hand.

Employment conditions are the best barometer of industry. According to the monthly report of the Chamber of Commerce the increase in employment for the past month is seven per cent., which fact, while not staggering, shows a better state of affairs than at any time since last May. The metal industries show the most encouraging increases in the entire list. The gain in actual percent is not the greatest, but the gain in numbers far overshadows other industries. The only decreases noted were in food, chemical and textile industries, and the Chamber of Commerce committee attributes these recessions to seasonal causes.

An item of interest to those connected with the metal and metal products industries is the resignation of President **Fred W. Ramsey,** of the **Cleveland Metal Products Company.** Although only 45, Mr. Ramsey retires with the intention of engaging in social work and civic movements with which he has long been connected. Mr. Ramsey was chairman of the campaign committee of the Cleveland Community Chest last year, and through his efforts $3,800,000 was raised within several weeks. He has already accepted the chairmanship for next year.

According to recent announcement, the heavy engine repair department of the **Toledo & Ohio Central Railroad** shops which has been closed for some time, will resume operations. The car repair department will not be affected by this order.

The first annual banquet of the local branch of the American Electro Platers Society is scheduled for March. This is the first event of its kind locally, hence it is creating considerable interest. An especially attractive program has been arranged. **Dr. W. R. Veazy,** eminent scientist and specialist on industrial chemistry as applied to metals, will deliver the address of the evening. His subject will be "The Mechanics of Solutions." Dr. Veazy holds a professorship at the Case School of Applied Science. **H. J. Ter Doest,** of Akron, Ohio, founder of the Cleveland branch of the society, is also scheduled to speak.—C. C. C.

INDIANAPOLIS, IND.

March 1, 1922.

The **Modern Brass Foundry Company** has been organized at Indianapolis, Ind., with a capitalization of $25,000 for the manufacturing and selling of brass and aluminum castings.

Fire starting in the plant of the **Frank Prox Foundry,** Terre Haute, Ind., recently, caused approximately $800 damages. The building which housed the furnaces was destroyed and several minor pieces of machinery were slightly damaged from the water.

Eruce Haynes, Crawfordsville, Ind., secretary-treasurer of the **Crawfordsville Foundry Company,** plans to move shortly to Davenport, Ia., to take a position as general manager of the Davenport branch of the **Nichols Wire and Sheet Company.**

Interests of the **B. & H. Plating Company,** Fort Wayne, Ind., have been acquired by the **National Specialties Company.** The purchasing company, which is engaged in the development and manufacture of mechanical specialties and tool and model work, has moved the equipment of the B. & H. firm to its own plant, making it the most complete metal plating and finishing plant in that city. **R. G. Heingartner,** formerly of the B. & H. Company, has been placed in charge of the plating department.—E. B.

MONTREAL, CANADA

March 1, 1922.

A decided improvement has taken place in the demand for non-ferrous goods this month and a spirit of confidence exists in the market. This feeling is getting stronger every week and manufacturers are now sure the turn has been reached and that once Spring opens up business will be back to near normal.

A decided improvement has taken place in the demand for small tools and shop supplies which is a sure sign of manufacturing production increasing. Compared with the peak days sales are far from good being around 50 per cent but the volume of existing business is encouraging under the present circumstances.

The **Canadian Car and Foundry Company** has completed the order for 140 motor street cars and 16 trailer cars for the **Toronto Transportation Commission,** and as there was a large quantity of brass fittings used on this order it was the means of keeping this plant busy along with their regular line.

Cuthbert & Sons Brass Works are running to their full capacity on a full line of plumbers brass goods and they are increasing their production every month by the addition of new lines of lavatory and bath room fittings.

The **Jenkins Company, Limited,** St. Remi street, are now running their plant five days per week with a promising outlook for business improving.—P. W. B.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The **Medart Patent Pulley Company,** St. Louis, Mo., has changed its corporate name to the **Medart Company.**

Fabyan and Company, Inc., dealers in drugs, chemicals, oils and sundries, have moved their warehouse and offices to 457 West Broadway, New York.

The **Causer Brass Finishing Company,** Boston, Mass., has been incorporated with a capital of $12,000. One of the incorporators is Joseph E. Sager, of Dedham, Mass.

The **Benner-O'Connell Company** and the **Ayer-O'Connell Company** have issued a joint statement of their financial condition and a plan of rehabilitating the companies.

The **Ingersoll-Rand Company,** 11 Broadway, New York, has been appointed general sales agent by the Rathbun Jones Engineering Company, 11 Broadway, New York, for their gas engines.

The **Phelps-Dodge Corporation** and the **American Smelting & Refining Company** have contracted to refine the Phelps-Dodge copper in the Perth Amboy plant of the A. S. & R. Company.

The **Richter Brass Company,** Cincinnati, Ohio, has increased its capital from $35,000 to $60,000. They operate a brass foundry, brass machine shop, tool room, grinding room, and plating and polishing departments.

A special meeting of the Directors of the **International Nickel Company,** New York, is scheduled to be held on Thursday for the purpose of selecting a new President to succeed the late William Bostwick.

The **Alliance Brass and Bronze Company,** Alliance, Ohio, recently increased its capital stock from $15,000 to $100,000. This company operates a brass, bronze and aluminum foundry, and has brass machine shop facilities.

The **K. & O. Company,** 366 Butler street, Brooklyn, N. Y., manufacturer of metal products, is having plans prepared by Frank Quimby, 110 William street, New York, for extensions and improvements in its five-story factory.

The **Amalgamated Metals Selling Co., Ltd.,** has been appointed sole U. S. Representative of the Erftwerke A. G., Grevenbroich, Cologne, Germany. This concern is known as the largest and most important producer of virgin aluminum in Germany.

The **Wilson Welder and Metals Company, Inc.,** 132 King street, New York, manufacturers of arc welding machines and certified welding metals announces the appointment of Mr. R. L. White as district manager in charge of the Detroit office, 809 Kresge building, Detroit, Mich.

Charles Flanel and **Simon Glaser,** both with the Brooklyn Alloys Company (now out of business) for about six years, have organized the **Keystone Smelting & Refining Company,** 43 Rutledge street, Brooklyn, N. Y. The company will smelt and refine white metals of all kinds.

Armstrong Cork and Insulation Company announces the following changes in the addresses of its branch offices: Armstrong Cork and Insulation Company, 725 Symes building, Denver, Colo.; Armstrong Cork and Insulation Company, 1204 Ulmer building, Cleveland, Ohio.

Ezra T. Feinberg will make application at a term of the County Court, Queens County, on March 11, 1922, at 10 A. M. for an order to approve claims as filed and declare a first and final dividend in the matter of the **Enameling & Stamping Corporation,** Long Island City, bankrupts.

In order to avoid confusion to customers, **V. Henning & Sons,** 330 Belmont Ave., Brooklyn, have advised that a metal company has been recently formed in New York which has for part of its name, a name similar to their own. V. Henning & Sons have not changed and have no branches.

The **Pyrene Manufacturing Company, Inc.,** Newark, N. J., announces it has enlarged the Parker Rustproofing Department at its new plant. The Pyrene Company has handled most of the Eastern jobbing in Parkerizing during the last year, and has now extended and enlarged this service.

The **Hilo Varnish Corporation,** Marcy and Flushing avenues, Brooklyn, N. Y., has established a sales office to cover the New England territory at 104 Hanover street, Boston, under the management of Edward B. Ludlow, formerly with Chas. H. Brown Company, who is well known throughout this territory.

The **Sundh Engineering and Machinery Company,** Philadelphia, Pa., manufacturer of finishing machinery for brass, copper and steel strip mills, has closed its branch office at 11th avenue and 26th street, New York City, and opened a Philadelphia downtown office in the Otis building, 16th and Sansom streets.

The **Central Brass Manufacturing Company,** 3 Balmforth avenue, Danbury, Conn., has recently been organized by M. M. Quamruddin, 100th street, that city, who is a wholesale dealer in plumbers', tinsmiths' and mill supplies. They are in the market for 25 pounds No. 190 emery grease and 25 pounds No. 150 emery grease, and would also like prices on belts for polishing machines.

The **Brooklyn Alloys Company,** 15 Walton street, Brooklyn, N. Y., has had a petition in bankruptcy filed against it by the Superior Metal Company for $480; the Pope Metal Company for $500, and the Shambroom Company for $400. Judge Chatfield has appointed Louis J. Castellano receiver, in bond of $2,000. Creditors may file claims in affidavit form with Eugene F. O'Conner, Jr., referee, 44 Court street, Brooklyn, N. Y.

Henning Bros. and Smith, Inc., Engert avenue and Eckford street, Brooklyn, N. Y., has been incorporated by Henry and Gustav Henning and M. H. Smith, with a capital of $18,000. They deal in scrap metals of all kinds, and supply the foundry trade with ingot metals as well as scrap metals in crucible shape. They are preparing plans for a building with about 10,000 sq. ft. of ground space, and will be in the market for equipment within a few months.

The **Stamford Rolling Mills Company,** Springdale, Conn., has sent out inquiries for complete oil engine power equipment with electrical generators for its two mills at Stamford and Springdale, Conn. Each power house will be approximately 2,500 h. p. and will supply motors on a rolling mill load, which are now installed. C. F. Hunter is general purchasing agent. This concern operates a casting shop, rolling mill, cutting-up shop, and tinning department.

The **Waterbury Manufacturing Company,** 236 Grand Street, Waterbury, Conn., manufacturer of sheet brass goods, etc., denies that it has recently purchased a factory on College Street, Middletown, Conn., from William E. Stroud. It is 50 x 102 ft. and will be used for the manufacture of its products. An addition is contemplated later. The report is absolutely incorrect. The Waterbury Manufacturing Company has made no purchase of a factory in Middletown.

A notice has been issued by the referee, John J. Townsend, in the matter of the bankruptcy of **Robert H. Ingersoll and Brothers,** New York, watch manufacturers, that a meeting of creditors will be held at the office of the referee 299 Broadway, room 1701, City of New York, on February 27, 1922, in order to act on the petition of the trustee in the action, who is applying for the authority to sell all the property of the bankrupt, real, personal or mixed, as a "going concern," under the direction of the referee.

The **Surface Combustion Company, Inc.,** industrial furnace engineers and manufacturers, of 366-368 Gerard avenue, New York, have secured the exclusive license for exploiting the Andrews Rust Proofing Process in this country and foreign countries. This process, used extensively during the war by the British Government, is now available to manufacturers for forming an ebony, rust-proofed finish on ferrous metals. It is claimed that this rust proofing process has stood the Government "salt-spray" test with 100% success.

The **Detroit Copper and Brass Rolling Mills,** Detroit, Mich., recently elected the following directors at its annual meeting: A. L. Buhl, L. D. Buhl, C. B. Davis, F. J. Hecker, F. H. Hoffman, L. H. Jones and R. P. Joy, H. J. Sheldon, and A. J. Peoples. The following officers were also elected: President and general manager, L. H. Jones; vice-presidents, R. P. Joy, and A. H. Buhl; and secretary-treasurer, A. J. Peoples; F. H. Hoffman, assistant general manager, and Alexander Henderson, works manager.

The **Guyan Machine Shops**, Logan, W. Va., are planning for the installation of new pulleys, belting and other transmission equipment. This concern operates a brass foundry, brass machine shop and tool room. They are also in the market for a turret lathe for brass bushing work; a lathe for turning steel locomotive wheels; punch and shear to handle ½ in. plate; chain hoists, ½ to 2 ton capacity; a quantity of shafting, steel and nickel, from 2 to 4½ in. in diameter and metal lockers and tool racks for machine shops.

SECONDARY METALS IN 1920

By J. P. Dunlop, U. S. Geological Survey

"Secondary metals" are those recovered from scrap metal, sweepings, skimmings, and drosses and are so called to distinguish them from metals derived directly from ores, which are termed "primary metals." The distinction does not imply that secondary metals are of inferior quality, for metals derived either from ore or from waste material vary in purity and in adaptability to use in making certain products. The reports to the United States Geological Survey now include secondary copper, zinc, lead, tin, antimony, aluminum, and nickel. The figures obtained by the Survey are supplemental to those on primary metals and are given to enable producers and consumers to form a more comprehensive idea of the quantities of metal available for consumption; in fact, they constitute an essential addition to those given in the seven general reports on primary metals.

SECONDARY METALS OF CERTAIN CLASSES RECOVERED IN THE UNITED STATES IN 1919 AND 1920

	1919		1920	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Copper, including that in alloys other than brass	112,400	$41,812,800	130,600	$48,060,800
Brass scrap remelted	249,700	75,944,100	259,800	77,454,500
Lead as metal	55,684	12,942,600	56,350	19,944,000
Lead in alloys	66,416		68,300	
Zinc as metal	39,910	6,711,900	42,850	8,181,000
Zinc in alloys other than brass and in chemical compounds.	6,062		7,650	
Tin as metal	5,977	29,868,200	7,200	22,705,700
Tin in alloys	18,056		16,300	
Antimony as metal	48	717,900	200	938,560
Antimony in alloys	4,351		5,400	
Aluminum as metal	6,017	12,014,600	5,000	9,489,100
Aluminum in alloys	12,674		10,500	
Nickel as metal	163	1,829,400	270	1,733,600
Nickel in nonferrous alloys.	2,284		1,930	
	.....	181,841,500	....	188,507,260

FRIGATE BURNED FOR ITS METAL

The old wooden frigate, Granite State, once a famous 84-gun ship, which was raised from where she had sunk, off Ninety-fourth street in the North River, will be burned to recover the copper used in her construction.

FORD COMPANY BUYS DETROIT ELECTRICS

The Detroit Electric Furnace Co., Detroit, received an order from the Ford Motor Company, Detroit, for five 2000-lb. 300 kva. Detroit rocking electric furnaces for the company's new brass foundry in the Highland Park plant. These furnaces will be equipped with automatic electrode control and with the first Detroit unit already installed, will give a capacity of approximately 150,000 lb. of metal per 16-hr. day. The furnaces will be in operation about April 1, 1922.

NAVY'S METAL SCRAP SOLD

Submitting figures ranging from 7.0199c. to 9.3899c. per lb. Herman Jaffe, 220 Broadway, New York, was the highest bidder for 9 out of 11 lots of copper and brass scrap offered by the Nevy Department, with bids of from 7.0199c. to 9.3899c. per lb. The quantity involved was 1,000,000 lb. The highest individual bid made was 9.76c. per lb., by the U. T. Hungerford Brass & Copper Company, New York, for 25,000 lb. of brass primer rods at Newport, R. I.

AMERICAN BRASS OFFICERS

The Directors of the American Brass Company at their meeting elected the following officers for a year:

Chairman of the Board of Directors, Charles F. Brooker; Vice Chairman and First Vice President, John P. Elton; President, John A. Coe; Executive Vice Presidents, Edward L. Frisbie, Thomas B. Kent and Gordon W. Burnham; Treasurer, Clifford F. Hollister.

The Executive Committee consists of Charles F. Brooker, Edward L. Frisbie, Thomas B. Kent, John P. Elton, Gordon W. Burnham, John A. Coe, George H. Allen, Clifford F. Holister, John D. Ryan, Cornelius F. Kelly and Benjamin B. Thayer. The last three directors are officials of the Anaconda Company.

INTERNATIONAL NICKEL COMPANY

The International Nickel Company has arranged to construct a complete Monel Metal Refinery, as an extension to the Rolling Mill, which will place them in a position of being able to produce at one plant Monel Metal rods, shapes and sheets, from bessemer matte produced at our smelter in Canada. This refinery will be in Huntingdon, W. Va.

They have as yet never manufactured Monel Metal products in Canada, their operations there being confined to the mining, smelting and refining of nickel and by-products from the Sudbury ores.

As regards the Monel Metal Products Corporation, whose works are at Bayonne, the present arrangements are based on operations continuing at these works.

CONSOLIDATED GENERAL PROFIT AND LOSS STATEMENT NINE MONTHS ENDING DECEMBER 31, 1921

Earnings		$143,713.96
Other Income		220,560.73
Total Income		$364,274.69
Administration and General Expense	$311,874.17	
Reserved for U. S. and Foreign Taxes	70,128.01	382,002.18
Net Income (Deficit)		$17,727.49
Maintenance and Shutdown Expense of Plants Not Operating	$228,266.09	
Depreciation and Mineral Exhaustion	395,684.53	623,950.62
Deficit		$641,678.11
Dividends		
Preferred No. 63 Paid August 1, 1921	$133,689.00	
Preferred No. 64 Paid November 1, 1921	133,689.00	
Preferred No. 65 Payable February 1, 1922	133,689.00	401,067.00
Balance (Deficit)		$1,042,745.11

New York, February 7, 1922.

INVESTIGATIONS BY BUREAU OF MINES

Employing cooperative funds furnished by the State of Missouri, an investigation relating to the electrothermic metallurgy of zinc is under way at the Mississippi Valley Experiment Station of the Bureau at Rolla, Mo. The physics and chemistry of the condensation of zinc vapor will be studied especially.

ELECTRICAL RESISTIVITIES OF GRANULAR AND MOLDED

Electrical resistivities of different resistor materials are being determined under different conditions of temperature, pressure, purity, etc., at the Northwest Experiment Station of the Bureau of Mines at Seattle, Wash., by Prof. G. R. Shuck of the University of Washington. It is hoped that these data will be of value in designing furnaces which use a resistor as the heating element or which make use of carbon as a reducing agent, and also for electrodes.

TRADE PUBLICATIONS

Knox Patented Damper Type Reversing Valves.—A folder issued by the Blaw-Knox Company, Pittsburgh, Pa., describing their damper-type valves for stacks and flues.

Tube Facts.—A pamphlet issued by the Scovil Manufacturing Company, Waterbury, Conn., illustrating and describing their plant and organization, and the process of making seamless tubing of copper, brass, etc. Copies of the booklet will be furnished to any one interested by the company upon request.

Staten Island, New York City.—Its Industrial Resources and Possibilities.—A booklet issued by the Merchants' Association of New York, being the second of a series illustrating and describing the industrial facilities to be found within the borders of Greater New York.

Ledrite.—A folder issued by the Bridgeport Brass Company, Bridgeport, Conn., introducing their Ledrite Brass Rod.

Deschanel Cableway Bulletin.—A pamphlet issued by the Deschanel Engineering Corp., 90 West street, New York, illustrating and describing their patented hoisting and conveying devices.

Testing that Pays Dividends.—A nicely printed and illustrated booklet issued by the Dorr Company, Engineers, 101 Park avenue, New York, illustrating and describing their organization and laboratory located at West Port, Conn.

Calido.—A folder issued by the Electrical Alloy Company, Morristown, N. J., covering their electrical resistance wire "Calido" for heaters, etc.

"Wodack" Electric Drill.—A circular letter issued by the Wodack Electric Corporation, 23 So. Jefferson street, Chicago, Ill., describing their combination portable electric drill and enclosing a photograph illustrating it.

Fibre Tubes.—A number of price lists issued by the Delaware Hard Fibre Company, Wilmington, Del., giving prices on Valcanized Fibre Sheets, Rods and Tubes.

National "Unxld" Guaranteed Chain.—A pamphlet together with price lists issued by the National Chain Company, Inc., Belleville, N. J., illustrating various sizes and types of steel chains.

Cooper Copper Carbonate.—A folder issued by Chas. Cooper and Company, 194 Worth street, New York City, setting forth the qualities of their copper carbonate for plating, etc., and containing an excerpt from "Platers' Wrinkles", published by the THE METAL INDUSTRY, and also listing other Cooper products.

Recent Work by D. P. R.—A folder issued by Dwight P. Robinson and Company, Inc., 125 East 26th street, New York, describing in brief and illustrating various recent industrial construction work done by them.

Walter H. Roe and Associate Engineers.—A pamphlet issued by this engineering firm, describing their organization and illustrating construction work done by them.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$375	$425
American Hardware Corp.	100	154	157
Bristol Brass	25	16	17¾
International Nickel, com.	25	11½	11¾
International Nickel, pfd.	100	62	65
International Silver, com.	100	20	40
International Silver, pfd.	100	92	95
New Jersey Zinc	100	135	137
Rome Brass & Copper	100	125	....
Scoville Mfg. Co.	100	325	350
Yale & Towne Mfg. Co.	...	280	295

Corrected by J. K. Rice, Jr., & Co., 36 Wall Street, New York.

Metal Market Review

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE

COPPER

Estimated sales of copper in February were between 60 million and 70 million pounds. Total sales since January 1st, by the largest producers, were in the neighborhood of 130 million pounds. Including sales in the outside market, the monthly average is probably 70 million pounds as compared with 100 million pounds sold in December, 1921. Statistically considered, however, further progress has been made, notwithstanding the smaller tonnage of sales. Deliveries into domestic consumption are estimated at 70 millions and exports 40 million pounds. Assuming refined production to have been 85 million pounds, stocks were reduced about 25 million pounds. Stocks of copper reserved for export have been reduced to less than 270 million pounds and by the time the increased domestic output becomes available, will have become much further reduced. In the meantime, consumption on both domestic and foreign account, it is confidently believed, will have increased materially.

The trend of prices during the month was downward, quotations at the end of the month in the outside market for prompt and March being, prime lake delivered 13c; electrolytic f. o. b. refinery 12.75c; casting f. o. b. refinery 12.50c, with April electrolytic f. o. b. refinery 12.75-12.87½c. Producers' prices electrolytic at the close, for March delivered were 12.87½-13c; second quarter nominal. As compared with prompt prices at the beginning of February, there was a net decline of ½c on lake, ⅝c on electrolytic and ¼c on casting in the outside market. Producers' prices on prompt showed a net decline of ¾c a pound. A decidedly better tone existed at the end of the month.

ZINC

The zinc market, after showing a declining tendency in prices, early in February, with lack of interest and slack demand, became steady in the second week with slowly increasing demand thereafter. The decline, amounting to five points, was halted February 9, at 4.50c East St. Louis, 4.85c New York for prompt and early primary, 4.60c brass special; April being held five points premium. The improved statistical position revealed about this time, showed a reduction of 1,000 tons in stocks January 31 as compared with stocks December 31. Although output was increased 1,700 tons in January, shipments also were increased, showing 2,200 tons more than in December. However, stocks on hand January 31, were 65,678 tons, indicating a three months' supply, and the January scale of output, if continued, it is estimated will be greater than the country can absorb under existing demand—any increase is surely unwarranted by present conditions. Moderate purchases by consumers, limited to small lots for prompt shipment, were the rule, up to the last day of the month, prices remaining unchanged until that day when recovery was made to 4.55c East St. Louis, 4.90c New York for primary, bid and asked, 4.65c brass special for prompt. April was advanced 2½ points over prompt, and May five points over April. The net result, therefore, was a fractional gain of 2½ points. Throughout the entire period of unchanged prices, no pressure was used in making sales, while at the same time, offerings by producers were light. Business done on the last day, was in increasing volume.

TIN

The tin market being largely of a speculative character, the volume of business done is misleading as compared with actual consumption of the metal. Prices, also, for the same reason, often are out of all proportion to values. Spot fluctuations in February covered a range of 2¾c a pound between the highest levels, 32c for Straits on February 8, 99% tin 31.25c February 1, and the lowest levels, Straits 29.25c, 99% tin 28.50c February 21. Following this, there was a recovery to Straits 30.87½c, 99% metal 30c but the recovery was due in large measure to shorts covering in speculative lots and the rise in London prices. American electrolytic throughout the month was quoted "nominal." Banca tin after a long absence also appeared in occasional offerings. Closing levels showed a decline after the recovery, and were Straits 30c, 99% tin 29.50c, making a net decline of 1⅞c on Straits and 1¾c on 99% metal.

LEAD

The only change in the New York spot lead market was due to the lower freight rates making a difference of five points to 4.70c February 2 instead of 4.70-4.75c previously. The only change in the East St. Louis price was from 4.37½-4.42½c, quoted throughout the month until the last day, when 4.40c bid and asked was the figure. The leading interest throughout the month, maintained its basis unchanged 4.70c East St. Louis and New York. The statistical position of lead is strong. Demand throughout February was well maintained with new business in fair volume constantly appearing; distribution being among all lead consuming interests making a very satisfactory condition.

ALUMINUM

Some encouragement was felt among aluminum dealers when two large orders were placed toward close of first fortnight. One coming from cooking utensil manufacturers was for 500,000 pounds and the other from a mid-West foundry for 1 million pounds. Cheap lots of foreign metal previously in the market disappeared at once. Prices, however, were not advanced on this buying, and with no further activity in the market, virgin ingots 98-99% pure were marked off ½c a pound on February 20 to 16.50-17.50c; other varieties remaining unchanged 16-17c for 98-99% remelted, 14-15c for No. 12 remelted. Toward the close some sellers of imported aluminum advanced 98-99% virgin ingots to 18c a pound but failed to establish this level since dealers offerings continued available at 17c, while bids received were only 16.50c. As a matter of fact, bona fide buyers at the close were able to purchase at prices below those given in regular quotations. The Aluminum Co. of America continued its January schedule unchanged throughout February, with 19.10c for 98-99% virgin and No. 12 alloy. Sheets 18ga and heavier were 35.20c for flat, 30.20c for coil, all in 15-ton lots f. o. b. shipping point carload rate of freight allowed.

ANTIMONY

Conditions in the antimony market were unchanged, except as to prices which declined another ten points to 4.25c for spot, duty paid carloads, 4.40-4.70c jobbing lots. Stocks are too full and consumers generally are well covered.

QUICKSILVER

Steady demand for quicksilver caused a rise to $50 per flask of 75 lbs. each, from the opening $48, by February 6. Supplies becoming more plentiful, $49 was bid by February 16 with $50 asked. By the 21st, because of the increasing general demand and the lack of supplies known to be afloat, as well as because of the rise in foreign exchange, the market was again very firm at $50 per flask for wholesale lots with $51 being asked for flasks in smaller lots. U. S. production in 1921 was the lowest of record, with only 6,339 flasks total, as compared with 13,392 flasks in 1920.

SILVER

The general tendency in price of foreign silver bars in February was downward after a rise in first three days which carried to the higest level 66⅝c an ounce. The lowest level 62¾c was at the closing, and the net decline from the opening 66⅛c amounted to 3⅜c. Importations in January were $6,495,758 and exports $3,977,118. The excess of imports over exports was $2,518,640. Domestic bars remained, of course, pegged 99⅝c.

PLATINUM

Because of rapidly increasing supplies during February, the price of platinum gradually declined from $100-105 per troy ounce to $85-90, a total recession of $15 per ounce.

OLD METALS

The February depression in major metals was quickly reflected in old metals, demand being quiet throughout the month with declines in prices ranging from ⅛c to 1c a lb. throughout the list. Coppers were in the lead in whatever movement existed. Toward the close there was some slight improvement in aluminum. Declines of 1c were on strictly crucibled copper to 10c; on No. 1 pewter to 15c and new type shell castings to 7c. Light copper and uncrucibled, each, were off ¾c to 7.50c for the former, 9.25c for the latter. Aluminum items, each, declined ½c; to 4c for clean turnings and borings, 11c for clippings and 8.50c each, for old sheet and old cast. The items of ¼c were light brass to 4.25c; heavy brass to 4.75c; composition scrap to 7.25c; cocks and faucets to 5.75c and clean hand picked type shells to 2.50c. Other declines were ⅛c each on new brass clippings and special heavy to 5.62½c. Some improvement in demand toward close.

FEBRUARY MOVEMENT IN METALS

	Highest	Lowest	Average
Copper:			
Lake	13.50	12.87½	13.24
Electrolytic	13.37½	12.62½	12.97
Casting	12.75	12.37½	12.61
Tin	32.00	29.25	30.82
Lead	4.42½	4.37½	4.40
Zinc (brass special)	4.65	4.60	4.60½
Antimony	4.40	4.25	4.38
Aluminum	18.00	16.50	17.33
Quicksilver (per flask)	50.00	48.00	49.58
Silver (cts. per oz.) foreign	62.00¾	66.00⅝	65.31

WATERBURY AVERAGE

Lake Copper—Average for 1920, 13.136.—January, 1922—13.875.—February,—13.375.

Brass Mill Zinc—Average for 1920, 5.175—January, 1922—5.25.—February, 5.00.

Metal Prices, March 6, 1922

NEW METALS

Open Market

COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 6 per centum.

	Cents
Electrolytic, carload lots, delivered	12¾-13c.
Lake, carload lots, delivered	13-13¼c.
Casting, carload lots, delivered	12⅝-12¾c.

TIN—Duty free.

Straits, carload lots	29⅜c.

LEAD—Duty, Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig, carload lots	4.70-4.75

ZINC—Duty 15%.

Brass Special	5.00
Prime, Western, carload lots	4.90

ALUMINUM—Duty, Crude, 2c. per lb. Bales, sheets, bars and rods, 3½c. per lb.

Small lots, f. o. b. factory	
100-lb. f. o. b. factory	
Ton lots, f. o. b. factory	16½-20.10

ANTIMONY—Duty 10%.

Cookson's Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	4.25

NICKEL—Duty, Ingot, 10% ad valorem. Sheet, strip, strip and wire, 20%.

Ingot	41.00
Shot	41.00
Electrolytic	31½-44

MANGANESE METAL—95-98% Mn., carbon free, per lb. Mn. contained. Nominal	0.75
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.25-1.35
BISMUTH—Duty free	2.00-2.10
CADMIUM—Duty free	1.00-1.25
CHROMIUM METAL—95-98% Cr., per lb. Cr. contained. Nominal	1.50
COBALT—97% pure	3.00-3.25
QUICKSILVER—Duty 10% per flask of 75 lbs.	$50
PLATINUM—Duty free, per ounce	$85-90
SILVER—Government assay—Duty free, per ounce	.99⅝
GOLD—Duty free, per ounce	20.67

Metal Prices, March 6, 1922

INGOT METALS

Silicon Copper, 10%	according	to	quantity	34 to38
Phosphor Copper, guaranteed 15%	"	"	"	19 to29
Phosphor Copper, guaranteed 10%	"	"	"	18½to28½
Manganese Copper, 30%	"	"	"	50 to56
Phosphor Tin, guarantee 5%	"	"	"	35⅝to45⅝
Phosphor Tin, no guarantee	"	"	"	41¾to51
Brass Ingot, Yellow	"	"	"	8¼to10½
Brass Ingots, Red	"	"	"	11¼to13
Bronze Ingot	"	"	"	11 to12¾
Parsons Manganese Bronze Ingots	"	"	"	16½to18
Manganese Bronze Castings	"	"	"	24 to33
Manganese Bronze Ingots	"	"	"	13 to16
Manganese Bronze Forgings	"	"	"	30 to40
Phosphor Bronze	"	"	"	24 to30
Casting Aluminum Alloys	"	"	"	18 to21
Monel Metal	"	"	"	38

OLD METALS

Buying Prices		Selling Prices
10 to10½	Heavy Cut Copper	11¾to12
9¾to10¼	Copper Wire	11½to11¾
8½to 9	Light Copper	10 to10½
8½to 9	Heavy Machine Comp.	10 to10½
5¾to 6¼	Heavy Brass	8 to 8½
4½to 5	Light Brass	6 to 6½
5¼to 5½	No. 1 Yellow Brass Turnings	6¼to 6¾
7 to 7½	No. 1 Comp. Turnings	8½to 9
4	Heavy Lead	4½
4	Zinc Scrap	4½
5 to 5½	Scrap Aluminum, Turnings	7 to 8
10½to11½	Scrap Aluminum, cast alloyed	12½to13½
13½to14½	Scrap Aluminum, sheet (new)	15½to16½
18½	No. 1 Pewter	22½
15	Old Nickel anodes	17
23 to25	Old Nickel	27 to29

BRASS MATERIAL—MILL SHIPMENTS

In effect Dec. 1, 1921

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.16¼	$0.17¾	$0.19¼
Wire	0.16¾	0.18¼	0.19¾
Rod	0.14¼	0.18¾	0.20¼
Brazed tubing	0.23	.....	0.28
Open seam tubing	0.23	.....	0.28
Angles and channels	0.25	.....	0.30

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.17¼	$0.18¾	$0.20¼
Wire	0.17¾	0.19¼	0.20¾
Rod	0.15¼	0.19¾	0.21¼
Brazed tubing	0.24	.....	0.29
Open seam tubing	0.24	.....	0.29
Angles and channels	0.26	.....	0.31

SEAMLESS TUBING

Brass, 18c. to 19c. per lb. base.
Copper, 20¾c. to 21¾c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin, Bronze Rod	18¼c.	net	base
Muntz or Yellow Metal Sheathing (14"x48")	16¼c.	"	"
Muntz or Yellow Rectangular Sheets other than Sheathing	17¼c.	"	"
Muntz or Yellow Metal Rod	14¼c.	"	"

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	20¼c.–21¼c. net base
From stock	21¼c.–22¼c. net base

BARE COPPER WIRE—CARLOAD LOTS

14¾c. to 15c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	18½c. per lb. base
100 lbs. to 200 lbs. in one order	19c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 8c. basis less 8 per cent. discount.

Casks, jobbers' prices	9c. to 9½c.
Open casks, jobbers' prices	10c. to 10½c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	35c.
Aluminum coils, 24 ga. and heavier, base price	30c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	24¼c.	per lb.
15% "	26 c.	" "
18% "	26¾c.	" "

Nickel Silver Wire and Rod

10% "	27¼c.	" "
15% "	31¼c.	" "
18% "	34 c.	" "

MONEL METAL

(Prices Nominal)

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	42
Cold Drawn Rods (base)	56
Hot Rolled Sheets (base)	55

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25s. over. Above prices f. o. b. mill.

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 67c. to 70c. per Troy ounce, depending upon quantity.

Rolled sterling silver, 65c. to 68c.

NICKEL ANODES

85 to 87% purity	.40c.	per lb.
90 to 92% "	.42½c.	per lb.
95 to 97% "	.45c.	per lb.

Supply Prices, March 6, 1922

CHEMICALS

In Commercial Quantities—New York Prices

Acid—		
Boric (Boracic) Crystals	lb.	.14
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02½
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls	lb.	.07
Nitric, 36 deg. Carboys	lb.	.07
Nitric, 42 deg. Carboys	lb.	.07¼
Sulphuric, 66 deg., Carboys	lb.	.02½
Alcohol—		
Denatured in bbls.	gal.	.36
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.05
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.20
Ammonium—		
Sulphate, tech., Barrels	lb.	.04
Sulphocyanide	lb.	.50
Argols, white, see Cream of Tartar	lb.	.28
Arsenic, white, Kegs	lb.	.06¼
Asphaltum	lb.	.35
Benzol, pure	gal.	.45
Blue Vitrol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.05½
Calcium Carbonate (Prescipitated Chalk)	lb.	.05
Carbon Bisulphide, Drums	lb.	.07½
Chrome Green	lb.	.36
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.48
Carbonate, Barrels	lb.	.19
Cyanide	lb.	.58
Sulphate, Barrels	lb.	.05¾
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.28
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton.	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	3.00
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.30
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.02½
Lead Acetate (Sugar of Lead)	lb.	.12-.13
Yellow Oxide (Litharge)	lb.	.09
Mercury Bichloride (Corrosive Sublimate)	lb.	.88
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.30-.40
Salts, single, bbls	lb.	.11
Salts, double, bbl.	lb.	.11
Paraffin	lb.	.07-.10
Phosphorus—Duty free, according to quantity		.25-.30
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	6½
Electrolytic, 70-75% fused	lb.	.10
Potassium Bichromate, casks	lb.	.11
Carbonate, 80-85%, casks	lb.	.05
Cyanide, 165 lb. cases, 94-96%	lb.	.42½
Pumice, ground, bbls	lb.	.04
Quartz, powdered	ton.	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.20
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.07½
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.45
Soda Ash, 58%, bbls	lb.	.03
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.05½
Bisulphate, tech., bbls	lb.	.03½
Cyanide, 96 to 98%, 100 lbs	lb.	.26
Hydrate (Caustic Soda) bbls	lb.	.04½
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.04
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass) bbls	lb.	2½
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls	lb.	.03
Tin Chloride	lb.	.33
Tripoli	lb.	.03½
Verdigris, see Copper Acetate	lb.	.48
Water Glass, see Sodium Silicate, bbls	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.21
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.14-.18
Chloride, 600 lb. lots	lb.	.06½
Cyanide	lb.	.42
Sulphate, bbls.	lb.	.03½

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	$33.80
14 " 20 " 64/68, "	"	42.05
12 " 20 " 84/92, "	"	42.55
14 " 20 " 84/92, "	"	57.35
Sewed Buffs, per pound		
Bleached and unbleached	"	.50

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	100 to 300 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"	2.60	2.50	2.35
" 6", 8" and over 16"	1" to3"	2.70	2.60	2.45
" 6" to 24"	Over 3"	3.00	2.90	2.75
" 6" to 24"	½" to 1"	3.60	3.50	3.35
" 4" to 6"	¼" to 3"	4.60	Any quantity	
" Under 4"	¼" to 3"	5.20	Any quantity	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes 50c advance.